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STAR

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Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also *34 Fluid Mechanics and Heat Transfer.*

03   Air Transportation and Safety   5

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04   Aircraft Communications and Navigation   11

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05   Aircraft Design, Testing and Performance   12

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*. For land transportation vehicles, see *85 Technology Utilization and Surface Transportation*.

07   Aircraft Propulsion and Power   19

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08   Aircraft Stability and Control   22

Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also *05 Aircraft Design, Testing and Performance* and *06 Avionics and Aircraft Instrumentation*.

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20   Spacecraft Propulsion and Power   35

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24   Composite Materials   44

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

25   Inorganic, Organic, and Physical Chemistry   46

Includes the analysis, synthesis, and use inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see also *34 Fluid Dynamics and Thermodynamics, For astrochemistry see category 90 Astrophysics.*

26   Metals and Metallic Materials   54

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

27   Nonmetallic Materials   58

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Typical Report Citation and Abstract

❶ 19970001126   NASA Langley Research Center, Hampton, VA USA

❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**

❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;

❹ Mar. 1996; 130p; In English

❺ Contract(s)/Grant(s): RTOP 505-68-70-04

❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

❼   To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10' to 50', and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65' swept forebody serrations tended to roll together, while vortices from 40' swept serrations were more effective in generating additional lift caused by their more independent nature.

❽ Author

❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics see categories 02 through 09. For information related to space vehicles see 12 Astronautics.

20000070410 NASA Langley Research Center, Hampton, VA USA
Aeronautical Engineering: A Continuing Bibliography with Indexes, Supplement 416
June 2000; 138p; In English
Report No.(s): NASA/SP-2000-7037/SUPPL416; NAS 1.21:7037/SUPPL416; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database. Records are arranged in categories: aeronautics, aerodynamics, air transportation and safety, aircraft communications and navigation, aircraft design, testing and performance, avionics and aircraft instrumentation, aircraft propulsion and power, aircraft stability and control, research and support facilities, astronautics, chemistry and materials, engineering, geosciences, mathematical and computer sciences, physics, social and information sciences, and space sciences.
CASI
Bibliographies; Aircraft Stability; Aircraft Instruments; Aircraft Engines; Aircraft Design; Aircraft Communication; Aerospace Engineering

20000072481 Illinois Univ. at Urbana-Champaign, Dept. of Aeronautical and Astronautical Engineering, Urbana, IL USA
Effects of Large-Droplet Ice Accretion on Airfoil and Wing Aerodynamics and Control *Final Report*
Bragg, M. B.; Loth, E.; Apr. 2000; 202p; In English
Report No.(s): PB2000-105936; DOT/FAA/AR-00/14; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

An integrated experimental and computational investigation was conducted to determine the effect of simulated ridge ice shapes on airfoil aerodynamics. These upper-surface shapes are representative of those which may form aft of protected surfaces in super-cooled large droplet conditions. The simulated ice shapes were experimentally tested on a modified National Advisory Committee for Aeronautics (NACA) 23012 (23012m) airfoil and Natural Laminar Flow (NLF) 0414 airfoil at Reynolds numbers of 1.8 million for a range of protuberance locations, sizes, and shapes. The computational study investigated the cases encompassed by the experimental study but in addition included higher Reynolds numbers and other airfoils from the NASA Commuter Airfoil Program.
NTIS
Aerodynamics; Aircraft Control; Wing Profiles; Control Surfaces; Ice Formation; Laminar Flow Airfoils

20000073707 Naval Postgraduate School, Monterey, CA USA
How the Naval Aviation Maintenance Program (NAMP) at the Intermediate Level Can Become ISO 9000 Quality Management System Compliant
Brenneman, Stephen K.; Dec. 1999; 141p; In English
Report No.(s): AD-A374354; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This thesis examines the similarities and differences between the Naval Aviation Maintenance Program (NAMP) and International Standards Organization (ISO) 9000 quality management systems (QMS), and what changes must be done to bring the NAMP to ISO 9000 standards. The NAMP is naval aviation's overall guiding document that outlines command, administrative,

and management relationships, and assigns maintenance policy and procedure responsibilities to the respective individuals for management. ISO 9000 is a series of international standards establishing requirements and guidelines for maintaining an organization's quality system, which focuses on prevention rather than detection This thesis will first examine ISO 9000 QMS aspects in relation to intermediate maintenance actions. Next, a plan for implementing the ISO 9000 QMS in naval aviation's organizational and intermediate maintenance activities is developed. Specifically, process maps are described for QM documentation, policies, and procedures under both the NAMP and ISO 9000, and then compared and contrasted. Then, a sample ISO 9000 quality manual for the Tool Control Program (TCP) on an intermediate maintenance activity, including how this manual can satisfy the 20 tenets of the ISO 9000 QMS is developed. Finally, recommended changes to NAMP QM procedures, processes, and policies are provided along with expected benefits naval aviation will receive if ISO 9000 is implemented.
DTIC
Aircraft Maintenance; Total Quality Management; Management Systems

20000073790 Department of Defense, Office of the Inspector General, Arlington, VA USA
Quality Assurance for Organic Depot Maintenance of Aircraft
Jun. 21, 1993; 50p; In English
Report No.(s): AD-A376771; IG/DOD-93-118; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The DOD quality assurance program is designed to ensure that the Military Departments' maintenance facilities provide operational systems, within specifications, that satisfy users' requirements. The program should ensure adequate quality throughout all areas of performance and provide for the prevention and ready detection of deficiencies, and for prompt and positive corrective actions. DoD budgeted about $4.1 billion for scheduled depot maintenance of aircraft for FY 1992. Increased budget pressure, as well as safety, requires that all work at military depots be performed correctly to reduce expensive rework and maintain safety and readiness.
DTIC
Aircraft Maintenance; Quality Control; Reliability Analysis

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also 34 Fluid Mechanics and Heat Transfer.

20000068996 NASA Langley Research Center, Hampton, VA USA
Hyper-X Engine Testing in the NASA Langley 8-Foot High Temperature Tunnel
Huebner, Lawrence D., NASA Langley Research Center, USA; Rock, Kenneth E., NASA Langley Research Center, USA; Witte, David W., NASA Langley Research Center, USA; Ruf, Edward G., NASA Langley Research Center, USA; Andrews, Earl H., Jr., FDC/NYMA, Inc., USA; [2000]; 16p; In English; 36th; 36th Joint Propulsion Conference, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-3605; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Airframe-integrated scramjet engine tests have 8 completed at Mach 7 in the NASA Langley 8-Foot High Temperature Tunnel under the Hyper-X program. These tests provided critical engine data as well as design and database verification for the Mach 7 flight tests of the Hyper-X research vehicle (X-43), which will provide the first-ever airframe- integrated scramjet flight data. The first model tested was the Hyper-X Engine Model (HXEM), and the second was the Hyper-X Flight Engine (HXFE). The HXEM, a partial-width, full-height engine that is mounted on an airframe structure to simulate the forebody features of the X-43, was tested to provide data linking flowpath development databases to the complete airframe-integrated three-dimensional flight configuration and to isolate effects of ground testing conditions and techniques. The HXFE, an exact geometric representation of the X-43 scramjet engine mounted on an airframe structure that duplicates the entire three-dimensional propulsion flowpath from the vehicle leading edge to the vehicle base, was tested to verify the complete design as it will be flight tested. This paper presents an overview of these two tests, their importance to the Hyper-X program, and the significance of their contribution to scramjet database development.
Author
Wind Tunnel Tests; Airframes; Data Bases; Engine Airframe Integration; Ground Tests; High Temperature

Low-Speed Wind Tunnel Tests on a Diamond Wing High Lift Configuration
Ghee, Terence A.; Taylor, Nigel J.; Jun. 2000; 5p; In English
Report No.(s): AD-A377908; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

    On modem military air vehicles, high lift systems are used to improve takeoff and landing performance. For naval air vehicles, an improvement in the lift coefficient of a landing or approach configuration allows for arrested landings at reduced speeds or the ability to carry more weight back to the ship. For conventional takeoff or landing (CTOL), improved lift to drag ratios allow for shorter takeoff runs or greater payload capacity.
DTIC
Wind Tunnel Tests; Low Aspect Ratio Wings; Aircraft Performance; Aerodynamic Configurations

Prediction of Transonic Vortex Flows Using Linear and Nonlinear Turbulent Eddy Viscosity Models
Bartels, Robert E., NASA Langley Research Center, USA; Gatski, Thomas B., NASA Langley Research Center, USA; May 2000; 35p; In English
Contract(s)/Grant(s): RTOP 522-31-21-05
Report No.(s): NASA/TM-2000-210282; L-17986; NAS 1.15:210282; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    Three-dimensional transonic flow over a delta wing is investigated with a focus on the effect of transition and influence of turbulence stress anisotropies. The performance of linear eddy viscosity models and an explicit algebraic stress model is assessed at the start of vortex flow, and the results compared with experimental data. to assess the effect of transition location, computations that either fix transition or are fully turbulent are performed. To assess the effect of the turbulent stress anisotropy, comparisons are made between predictions from the algebraic stress model and the linear eddy viscosity models. Both transition location and turbulent stress anisotropy significantly affect the 3D flow field. The most significant effect is found to be the modeling of transition location. At a Mach number of 0.90, the computed solution changes character from steady to unsteady depending on transition onset. Accounting for the anisotropies in the turbulent stresses also considerably impacts the flow, most notably in the outboard region of flow separation.
Author
Transonic Flow; Vortices; Nonlinearity; Eddy Viscosity; Three Dimensional Flow; Mathematical Models

Wind tunnel test of the RISOe-1 airfoil
Fuglsang, P.; Antoniou, I.; Bak, C.; Madsen, H. A.; May 31, 1998; 45p; In English
Report No.(s): DE98-768891; RISO-R-999(EN); ISBN 87-550-2329-0; No Copyright; Avail: Department of Energy Information Bridge

    Wind tunnel tests with approximately 2D flow were carried out for the RISOe-1 airfoil in the VELUX open jet wind tunnel. The airfoil section was mounted in a test stand equipped with end plates to retain 2D flow conditions. The stand was then inserted into the tunnel test section. The Reynolds number was 1.6 million, the chord of the airfoil model 0.6 m and the span 1.9 m. Pressure distribution measurements provided the aerodynamic load coefficients and wake rake pressure measurements provided the total drag coefficient. Wind tunnel corrections were applied for streamline curvature and down-wash. Steady inflow measurements showed that the airfoil behaved well with a well defined maximum lift coefficient of 1.3, a minimum drag of 0.0075, and a smooth stall region. Comparisons with numerical predictions from the EllipSys2D Navier-Stokes code showed good agreement among the calculated and measured lift and drag coefficients. Leading edge roughness devices were found to reduce the maximum lift coefficient by 15% to 1.1 and to increase the drag coefficient at low incidence. Dynamic inflow measurements with the airfoil in pitching motion were carried out to study the hysteresis effects on the aerodynamic coefficients. The lift coefficient hysteresis loops at high incidence had smooth shapes and did not show leading edge separation. Steady inflow measurements at high angles of attack showed that the airfoil flow was stationary and did not indicate double stall.
NTIS
Wind Tunnel Tests; Airfoil Profiles; Aerodynamic Coefficients; Pressure Measurement; Aerodynamics; Turbulent Flow

Development of a Scale Model Parachute Wind Sensor *Final Report*
Luers, James K.; Nov. 1998; 17p; In English
Contract(s)/Grant(s): F49620-98-1-0357; AF Proj. 2302

Report No.(s): AD-A376978; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    A scale model parachute GPS wind sensor is to be designed that will follow the same trajectory as that of a full size PAD payload. This will allow the wind field to be measured where it is most needed, along the descent path of the payload. In actual operation the scale model sensor would be released shortly before the payload, the wind field calculated in real time during descent, and used in the CARP algorithm to calculate the payload release point. In order for the scale model parachute system to follow the same trajectory as the full size payload system several scaling parameters must be analyzed. A necessary condition that the airflow around scale model system. Since the flow around an object depends upon Reynolds and mach numbers, a change in these parameters could cause the airflow to change and thus the drag coefficients to change between the scale model and full size systems. The mach number will remain the same for the two systems because the systems are designed to maintain the same trajectory. The Reynolds Number however, will be necessity vary because of the difference in the dimensions of the two systems. Thus it must be established whether the variation in Reynolds number over the range that occurs between the full and scaled systems significantly changes the drag coefficient of the systems. Other parameters that may change the relative airflow between the two systems are the porosity of the parachute fabric, the mass of each systems, the length of the tether lines, and the size air passage opening in the center of each parachute. Each of these parameters is addressed in the following analyses.
DTIC
Global Positioning System; Scale Models; Wind Measurement; Wind Velocity; Real Time Operation; Parachutes; Payloads

20000072489 NASA Langley Research Center, Hampton, VA USA
Lead-Lag Control for Helicopter Vibration and Noise Reduction
Gandhi, Farhan, Pennsylvania State Univ., USA; [1995]; 22p; In English
Contract(s)/Grant(s): NAG1-2050; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    As a helicopter transitions from hover to forward flight, the main rotor blades experience an asymmetry in flow field around the azimuth, with the blade section tangential velocities increasing on the advancing side and decreasing on the retreating side. to compensate for the reduced dynamic pressure on the retreating side, the blade pitch angles over this part of the rotor disk are increased. Eventually, a high enough forward speed is attained to produce compressibility effects on the advancing side of the rotor disk and stall on the retreating side. The onset of these two phenomena drastically increases the rotor vibratory loads and power requirements, thereby effectively establishing a limit on the maximum achievable forward speed. The alleviation of compressibility and stall (and the associated decrease in vibratory loads and power) would potentially result in an increased maximum forward speed. In the past, several methods have been examined and implemented to reduce the vibratory hub loads. Some of these methods are aimed specifically at alleviating vibration at very high flight speeds and increasing the maximum flight speed, while others focus on vibration reduction within the conventional flight envelope. Among the later are several types passive as well as active schemes. Passive schemes include a variety of vibration absorbers such as mechanical springs, pendulums, and bifilar absorbers. These mechanism are easy to design and maintain, but incur significant weight and drag penalties. Among the popular active control schemes in consideration are Higher Harmonic Control (HHC) and Individual Blade Control (IBC). HHC uses a conventional swash plate to generate a multi-cyclic pitch input to the blade. This requires actuators capable of sufficiently high power and bandwidth, increasing the cost and weight of the aircraft. IBC places actuators in the rotating reference frame, requiring the use of slip rings capable of transferring enough power to the actuators. Both schemes cause an increase in pitch link loads. Trailing Edge Flap (TEF) deployment can also used to generate unsteady aerodynamic forces and moments that counter the original vibratory loads, and thereby reduce rotor vibrations. While the vibrations absorbers, HHC, IBC, and TEF concepts discussed above attempt to reduce the vibratory loads, they do not specifically address the phenomena causing the vibrations at high advance ratios. One passive method that attempts to directly alleviate compressibility and stall, instead of reducing the ensuing vibrations, is the use of advanced tip designs. Taper, sweep, anhedral, and the manipulation of other geometric properties of the blade tips can reduce the severity of stall and compressibility effects , as well as reduce rotor power. A completely different approach to solve these problems is the tiltrotor configuration. As the forward velocity of the aircraft increases, the rotors, in this case, are tilted forward until they are perpendicular to the flow and act as propellers. This eliminates the edgewise flow encountered by conventional rotors and circumvents all the problems associated with flow asymmetry. However, the success involves a tremendous increase in cost and complexity of the aircraft. Another possible approach that has been proposed for the alleviation of vibratory loads at high forward flight speeds involves the use of controlled lead-lag motions to reduce the asymmetry in flow. A correctly phased 1/rev controlled lag motion could be introduced such that it produces a backward velocity on the advancing side and a forward velocity on the retreating side, to delay compressibility effects and stall to a higher advance ratio. Using a large enough lead-lag amplitude, the tip velocities could be reduced to levels encountered in hover. This concept was examined by two groups in the 1950's and early 1960's. In the USA, the Research Labs Division of United Aircraft developed a large lead-lag motion rotor, meant to achieve lag motion amplitudes up to 45 degrees. In order to reduce the required actuation force, the blade hinges were moved to 40% of the blade radius to increase the rotating lag frequency to approximately 1/rev. The blade hinges were redesigned

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to produce a flap-lag coupling so the large flapwise aerodynamic loads could be exploited to actuate the blades in the lag direction. A wind tunnel test of this rotor concept revealed actuation and blade motion scheduling problems. The project was eventually discontinued due to these problems and high blade stresses. Around the same time, at Boelkow in Germany, a similar lead-lag rotor program was conducted under the leadership of Hans Derschmidt. Here, too, the blade hinges were moved outboard to 34% radius to reduce the actuation loads. The main difference between this and the United Aircraft program was the use of a mechanical actuation scheme with maximum lead-lag motions of 400. This program was also discontinued for unclear reasons. The present study is directed toward conducting a comprehensive analytical examination to evaluate the effectiveness of controlled lead-lag motions in reducing vibratory hub loads and increasing maximum flight speed. Since both previous studies on this subject were purely experimental, only a limited data set and physical understanding of the problem was obtained. With the currently available analytical models and computational resources, the present effort is geared toward developing an in-depth physical understanding of the precise underlying mechanisms by which vibration reduction may be achieved. Additionally, in recognition of the fact that large amplitude lead-lag motions would - (i) be difficult to implement, and (ii) produce very large blade stresses; the present study examines the potential of only moderate-to-small lead-lag motions for reduction of vibratory hub loads. Using such an approach, the emphasis is not on eliminating the periodic variations in tangential velocity at the blade tip, but at best reducing these variations slightly so that compressibility and stall are delayed to slightly higher advance ratios. This study was conducted in two steps. In the first step, a hingeless helicopter rotor was modeled using rigid blades undergoing flap-lag-torsion rotations about spring restrained hinges and bearings. This model was then modified by separating the lead-lag degree of freedom into two components, a free and a prescribed motion. Using this model, a parametric study of the effect of phase and amplitude of a prescribed lead-lag motion on hub vibration was conducted. The data gathered was analyzed to obtain an understanding of the basic physics of the problem and show the capability of this method to reduce vibration and expand the flight envelope. In the second half of the study, the similar analysis was conducted using an elastic blade model to confirm the effects predicted by the simpler model.
Derived from text

Active Control; Aerodynamic Forces; Aerodynamic Loads; Aircraft Noise; Harmonic Control; Helicopters; Horizontal Flight; Vibration; Vibration Damping; Noise Reduction

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety; and 85 Technology Utilization and Surface Transportation.

20000068449 Futron Corp., Bethesda, MD USA
Report on the Effects of Parachutes on Risk Mitigation to Third-party Property and Individuals
Mears, A. K., Futron Corp., USA; Mar. 1993; 10p; In English
Report No.(s): PB2000-105824; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

A study on the public's exposure to risk caused by an object or payload landing upon its arrival from an orbital or suborbital flight trajectory. An investigation was conducted looking for research that may have been done or information that may have been gathered that is able to qualitatively or quantitatively discuss the magnitude of risk, or differential (delta) due to the presence of a parachute, to people or property on the ground in comparison to the risks of an object descending in free fall; essentially ballistically. The basic question the study seeks to answer is: 'Why is it safe to release an object on a parachute while it is unsafe to release it without a parachute.'
NTIS

Flight Paths; Parachutes; Payloads; Suborbital Flight; Risk; Parachute Descent

20000070325 General Accounting Office, Resources, Community and Economic Development Div., Washington, DC USA
Essential Air Service Changes in Passenger Traffic, Subsidy Levels, and Air Carrier Costs
Anderson, John H., Jr; May 25, 2000; 16p; In English; Testimony: Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives
Report No.(s): AD-A377720; GAO/T-RCED-00-185; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over two decades have passed since the Congress phased out the federal government's control over airfares and service. Concerned that air service to some small communities would suffer in a deregulated environment, the Congress established the Essential Air Service (EAS) program as part of the Airline Deregulation Act of 1978 and made special provisions for providing

this service in Alaska. The objective of the EAS program, administered by the Department of Transportation (DOT), is to ensure that small communities that had received scheduled passenger air service before deregulation continued to have access to the nation's air transportation system. DOT does this by awarding subsidies to carriers willing to provide service to communities that would not otherwise receive it. Recently, we issued a report on changes in the subsidy levels and costs for the EAS program in 1999 compared with 1995. Our testimony today, which is based on information developed for that report, focuses on three major topics: (1) changes in the number of communities and passengers receiving subsidized service, (2) changes in the level of subsidies provided, and (3) reasons why the subsidy levels changed.
DTIC
Governments; Regulations; Rules; Costs; Cost Analysis

20000070352 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
Department of the Navy NITE Lab Training
Antonio, Joseph; Oct. 08, 1999; 6p; In English
Report No.(s): AD-A376038; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
The purpose of this briefing is to provide an update on night vision goggle training conducted in the Marine Corps and Navy Night Imaging and Threat Evaluation (NITE) Lab training facilities, and to describe changes in the mechanism in which courseware and instruction is standardized. The NITE Lab concept has continued to evolve since its development in the mid-1980s. Today, it is thoroughly integrated with simulator and flight training, all combined to provide aircrew with as much information and practical experience as possible before the first tactical sortie. Additionally, the designation of a model manager position will help insure that quality instruction is provided to all aircrew and that funding will be available to support the necessary efforts.
DTIC
Night Vision; Imaging Techniques; Goggles; Training Simulators; Flight Training

20000070422 Defence Science and Technology Organisation, Airframes and Engines Div., Melbourne, Australia
Trial of Global Positioning System Based Field Wreckage Plotting and Analysis Equipment Using Data from a USMC F/A-18 Aircraft Accident
Barber, S. A.; Molent, L.; Jun. 1999; 56p; In English
Report No.(s): AD-A368420; DSTO-TR-0828; DODA-AR-010-993; Copyright; Avail: Defense Technical Information Center (DTIC)
On August 20, 1998 a USA Marine Corps F/A-18 aircraft crashed at Delamere bombing range in the Northern Territory. AMRL was invited to aid in the investigation by trialing the AMRL wreckage mapping and analysis equipment at the site. The equipment was used to plot and record all wreckage of interest. Maps of the wreckage were produced on site and handed over to the accident investigation team. These rapidly produced maps, along with the experience brought with the AMRL investigators with on site wreckage examination, greatly aided the accident investigation team to expedite recovery of the site and clarify many aspects of the accident to this end, the trial of the equipment was very successful. Following this trial, the data was used to explore the capabilities of other visualisation software, and its relevance to accident investigation. The results of this are presented during the discussion of the accident.
DTIC
Global Positioning System; Plotting; Wreckage; F-18 Aircraft; Aircraft Accidents

20000070473 Naval Postgraduate School, Monterey, CA USA
Development of An Expert System and Software Agent for Aviation Safety Assessment
Flowers, Thomas R.; Dowler, David M.; Mar. 2000; 158p; In English
Report No.(s): AD-A377634; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The primary goal of this thesis is to design, develop and test an internet based prototype model for using expert system and software agent technologies to automate some of the analytical tasks in conducting aviation safety assessments using the data collected by the automated Aviation Command Safety Assessment (ACSA) system. The Aviation Command Safety Assessment is a questionnaire survey methodology developed to evaluate a Naval Aviation Command's safety climate, culture, and safety program effectiveness. The survey was a manual process first administered in the fall of 1996. The survey was then automated in 1999 and is administered over the World Wide Web. The results of this thesis are a prototype model and a software agent application that evaluates data contained in the ACSA database for organizational safety assessment and for database integrity. All source code is provided and discussed in detail.
DTIC
Aircraft Safety; Flight Safety; Software Engineering; Computer Programs; Expert Systems

6

Galaxy Scientific Corp., Egg Harbor Township, NJ USA
Denver International Airport Sensor Processing and Database *Final Report*
Dong, M.; Hayhoe, G. F.; Mar. 2000; 62p; In English
Report No.(s): PB2000-104060; DOT/FAA/AR-00/17; No Copyright; Avail: National Technical Information Service (NTIS)

   Data processing and database design is described for an instrumentation system installed on runway 34R at Denver International Airport (DIA). Static (low-speed) and dynamic (high-speed) sensors are installed in the pavement. The static sensors include thermistors, resistivity probes, time domain reflectometer (TDR) moisture gages, strain gages, and joint gages sampled at a rate of once per hour. Dynamic sensors include infrared (IR) position sensors, multidepth deflectometers, strain gages, and geophones sampled at approximately 160 Hz. Peak values in the dynamic sensor records are automatically computed. The data structure for storing data from the dynamic sensors is based on single aircraft events consisting of all data collected during the passage of a single aircraft over the section of instrumented pavement.
NTIS
Airports; Data Bases; Data Processing; Sensors; Measuring Instruments

20000072582 Nebraska Univ., Aviation Inst., Omaha, NE USA
The Conference Proceedings of the 1997 Air Transport Research Group (ATRG) of the WCTR Society, Volume 1
Own, Tae Hoon, Editor, British Columbia Univ., Canada; Bowen, Brent D., Editor, Nebraska Univ., USA; September 1997; 152p; In English; Air Transport Research, 25-27 Jun. 1997, Vancouver, Canada; Sponsored by World Conference on Transportation Research Society, Unknown; See also 20000072583 through 20000072589
Report No.(s): UNOAI-97-4-Vol-1-No-3; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche

   The Aviation Institute University of Nebraska at Omaha (UNO) Monograph series has published the Conference Proceedings of the 1997 Air Transport Research Group (ATRG) of the World Conference on Transportation Research Society (WCTR) volume 1, number 3. The topics included in this document are: 1) Industrial Reform and Air Transport Development in China; 2) The Economic Effects of Airline Deregulation and the Open-Sky Policy of Korea; 3) The Economic Effects of Airline Deregulation and the Open-Sky Policy of Korea; 4) "Open Skies" in India-Is the policy succeeding? 5) The Japanese Domestic Air Fares under the Regulatory Regime: What will be expected after the revision of current charging system? 6) The Competitive Position of Airline Networks; and 7) Air Transport and Regional Economic Development in the European Union.
CASI
Air Transportation; Airline Operations; Economic Development; Policies

20000072583 City Univ. of Hong Kong, Dept. of Economics and Finance, Kowloon, Hong Kong
Industrial Reform and Air Transport Development in China
Zhang, Anming, City Univ. of Hong Kong, Hong Kong; The Conference Proceedings of the 1997 Air Transport Research Group (ATRG) of the WCTR Society; September 1997; Volume 1, No. 3; 20p; In English; See also 20000072582; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

   This article describes the regulatory and enterprise reform in the Chinese airline industry and its impact on the industry's development. China's transport sector is one of the largest sectors of the Chinese economy while aviation has been the fastest growing mode. Chinese civil air transport has grown by an average of 20 percent a year since 1980 - 4.3 times the world average. The article starts with a description of China's general economic and industrial reform, followed by a description of reforms in the air transport sector. It then examines the impact of the reform on the growth and development of China's airline industry. In particular, the following aspects of the industry are discussed: air traffic growth and route development, market structure, and airline operation and competition.
Author
Air Transportation; China; Civil Aviation; Industries; Air Traffic

20000072584 Hankuk Aviation Univ., Kyunggido, Korea, Republic of
The Economic Effects of Airline Deregulation and the Open-Sky Policy of Korea
Lee, Yeong–Heok, Hankuk Aviation Univ., Korea, Republic of; The Conference Proceedings of the 1997 Air Transport Research Group (ATRG) of the WCTR Society; September 1997; Volume 1, No. 3; 12p; In English; See also 20000072582; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

   From 1948 up to the year of 1969, Korean civil aviation industry had been negligible due to Korean War, political turmoil, and poor economic growth. During these years international air transport in Korea was serviced mainly by the foreign carriers of Northwest Air, Japan Air, and Cathay Pacific Air. But since 1969 when KAL (Korean Air Lines) was privatized, Korean civil aviation industry has developed very rapidly thanks to the successful growth of Korean economy and the active business of KAL.

During the twenty five-year period of 1970-95, the air transport market in Korea has considerably expanded at the annual growth rate of 14.2% on the domestic routes and 21.5% on the international routes, while the annual economic growth rate of Korea was only 8.7%. Especially in the second half of 1980's, owing to the Seoul Olympic Games, the liberalization of overseas travel by the government, and the unprecedented economic boom, the air transport market has grown at the annual rate of 34.1% domestically and 18.7% internationally. The market share of Korean carriers on the international routes was above 60% in the late 1980's. After it decreased to 46.7% in 1990 due to the active frequency increase of foreign carriers, it increased significantly to 64.5% in 1995 due to the second carrier (Asiana Airlines)'s growth.

Derived from text

Civil Aviation; Economics; Korea; Policies; Aircraft Industry; Airline Operations; Air Transportation

20000072585 Sydney Univ., Inst. of Transport Studies, Australia

"Open Skies" in India: Is the Policy Succeeding?

Hooper, Paul, Sydney Univ., Australia; The Conference Proceedings of the 1997 Air Transport Research Group (ATRG) of the WCTR Society; September 1997; Volume 1, No. 3; 21p; In English; See also 20000072582; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

With a "middle class" of 200 million people in a large country where travel between the major population centres by surface transport can be arduous, India has a potentially large domestic airline market. In the post-World War III period, India nationalized its airline industry into one international carrier, Air India, and one domestic carrier, Indian Airlines, but it began to relax these controls in 1986. Since then, a series of policy initiatives introduced what is proclaimed to be an "open skies" policy. There has been no shortage of new entrants willing to add capacity into a system where supply-side constraints are regarded as the main impediments to a boom in airline travel. However, many of these new ventures have failed within a few years and the remaining carriers, including Indian Airlines, have had to increase fares in an attempt to improve their financial performance. Far from being an "open skies" environment, airline managers continue to be subject to formal and informal government regulations and government has introduced new taxes and increased charges for aviation services. The result is an industry characterized by financial instability and low traffic growth. This paper documents the changes in the regulatory system and analyses the strategies adopted by the airlines. It is concluded that inappropriate policies are constraining development of the industry, particularly the requirement imposed by the Government for the airlines so allocate their capacity on a mix of profitable and unprofitable routes.

Author

India; Policies; Airline Operations; Industries; Civil Aviation

20000072586 British Columbia Univ., Vancouver, British Columbia Canada

The Japanese Domestic Air Fares Under the Regulatory Regime: What will be Expected After the Revision of Current Charging System?

Murakami, Hideki, British Columbia Univ., Canada; The Conference Proceedings of the 1997 Air Transport Research Group (ATRG) of the WCTR Society; September 1997; Volume 1, No. 3; 17p; In English; See also 20000072582; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This paper statistically investigates the charging system of Japanese domestic air fares and predicts the effect of the revision of current system on the consumer's surplus. Using 222 cross section data of 1995, this paper unveiled that (a) the fares in the long haul markets were set higher regardless of the number of passengers, (b) in the outstandingly dense markets, the fares were set higher than the predicted full cost level, (c) however, in the thin and shorter haul markets, fares were a little lower. Considering the price elasticity of these three types of routes, this paper concluded that the reduction of air fares in the long haul markets (especially dense markets) to the "distance-proportional level" would lead to the substantial gain of consumer's surplus, and this would surpass the loss of consumer's surplus that might arise in shorter haul routes. There still remains substantial room for the Japanese government to improve the consumer's benefit without worsening, or maybe with improving, the status quo of the airlines.

Author

Airline Operations; Civil Aviation; Costs; Japan; Regulations; Market Research

20000072587 Civil Aviation Authority, Netherlands

The Competitive Position of Airline Networks

Veldhuis, Jan, Civil Aviation Authority, Netherlands; The Conference Proceedings of the 1997 Air Transport Research Group (ATRG) of the WCTR Society; September 1997; Volume 1, No. 3; 15p; In English; See also 20000072582; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The contents of this paper is as follows. Firstly quality and frequency of direct as well as indirect connections are operationalized by variables indicating the 'connectivity' between markets. Secondly this concept is illustrated by introducing the so-called

'connectivity matrix' which is a simple statistical representation of the performance of any airport in the markets served from and via these airports. Before introducing this concept we have defined a study area, as well as a classification of five airport classes. The study area is Western Europe, consisting of Benelux, UK, Ireland, France, Germany, Denmark, Switzerland and Austria. The five airport classes are: 1) The 'mainports' in Western Europe: London Heathrow, Paris CDG, Frankfurt and Amsterdam; 2) The 'secondary' airports in Western Europe: Brussels, Luxemburg, London Gatwick, Manchester, Dublin, Paris Orly, Lyon, Berlin Tegel, Munich, Copenhagen, Zurich and Vienna; 3) Regional airports: all other airports in Western Europe; 4) All other airports in Europe, outside Western Europe; and 5) All airports outside Europe.
Derived from text
Airline Operations; Airports; Europe; Market Research

20000072588 New Univ. of Ulster, School of Environmental Studies, Coleraine, UK
Air Transport and Regional Economic Development in the European Union
Graham, Brian, New Univ. of Ulster, UK; The Conference Proceedings of the 1997 Air Transport Research Group (ATRG) of the WCTR Society; September 1997; Volume 1, No. 3; 20p; In English; See also 20000072582; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

    The general objective of this paper, which concentrates on scheduled passenger air services, is to discuss the European Union's (EU) aviation liberalization policy within the specific context of the variable economic performances and potentials of regions. Almost all previous discussions of the actual and potential repercussions of this policy have been dominated by the inter-related issues of competition and privatization. It is argued here, however, that the patterns of demand within the EU's air transport network are shaped by economic and social forces external to the mode, which impact differentially upon - and often constrain - the effectiveness of aviation liberalization measures. Although the precise causal relationship between infrastructural provision and economic development is less than clear, the EU and individual Member State governments have invested heavily in transport and other infrastructure as a stimulus to economic growth and to help attract inward investment to less advantaged regions. Perhaps the most obvious manifestation of this process is provided by the Trans-European Networks (TENS) being constructed to underpin the Single European Market (SEM). The Trans-European Transport Network (TETN), for example, is envisaged as a means of enhancing accessibility and integration, while harmonizing national networks into a macro-network for the EU as a whole, not least by providing missing connections (often at border locations) and the attempted elimination of bottlenecks. This initiative, which embraces rail, road, maritime and air transport modes, is also linked to other EU policies and objectives being articulated through the Regional Development and Structural Funds, which aim at socio-economic convergence and cohesion through the reduction of income inequalities and development disparities between central and peripheral regions and the promotion of an EU characterized by greater solidarity and social inclusion. Infrastructure has been a primary recipient of such investment, much of the expenditure being concentrated in the four poorest countries - Spain, Portugal, Ireland and Greece.
Derived from text
Air Transportation; Economic Development; Europe; Regions; Policies

20000072589 Pittsburgh Univ., Graduate School of Public and International Affairs, Pittsburgh, PA USA
Surviving the Single Market: Corporate Dilemmas and Strategies of European Airlines
Staniland, Martin, Pittsburgh Univ., USA; The Conference Proceedings of the 1997 Air Transport Research Group (ATRG) of the WCTR Society; September 1997; Volume 1, No. 3; 34p; In English; See also 20000072582; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

    In April 1997, the liberalization of air transport within the European Union enters its final phase, in which carriers will be free to operate between all airports within the Union, and particularly on routes within Member-States. This change is potentially as radical in its implications as airline deregulation was in the US, although it mainly entails the opening of new markets to all airlines, rather than the removal of general regulatory controls on routes and pricing as was the case in the US. This paper examines, using the air transport case, the complicated interaction between deregulation (in fact, variable and asymmetrical deregulation across several markets), economic integration (represented by the establishment if the Single Market), and corporate strategy (expressed in the responses of European carriers to the challenges facing many service industries).
Derived from text
Air Transportation; Airline Operations; Airports; Market Research; Europe

20000073309 Department of Defense, Office of the Inspector General, Arlington, VA USA
AV-8B Aircraft Class A Mishaps and Engine Problems
Jul. 23, 1992; 23p; In English
Report No.(s): AD-A377530; IG/DOD-92-126; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We audited selected facets of the AV-8B Aircraft Program as requested by Congress in Conference Report 102-311, "National Defense Authorization Act for Fiscal Years 1992 and 1993," November 13, 1991. Congress requested that we conduct a comprehensive investigation into the high incidence of AV-8B mishaps classified as class A and the chronic AV-8B engine problems. Congress also requested that the General Accounting Office and the Inspector General review the management and the funding of the AV-8B Program. House and Senate Committee staff members agreed to have the General Accounting Office review the management and funding of the AV-8B program and keep the Inspector General abreast of their audit results.
DTIC
Aircraft Accidents; Congressional Reports; Harrier Aircraft

20000073726 Naval Postgraduate School, Monterey, CA USA
An Analysis of Decision Making Strategies Used by P-3 Pilots in Hazardous Situations
Watt, Christopher J.; Mar. 2000; 112p; In English
Report No.(s): AD-A376768; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
Effective decision making in aeronautical environments, which often involves high elements of risk, is critical to mission success. Unfortunately, no proven methodology exists to train pilots to make successful decisions. Cockpit decision making has relied on traditional analytical models and methodologies that underestimate the role of pilot experience, expertise and judgement Naturalistic Decision Making models (NDM) contend that decision makers facing real-world decisions use experience and judgement to make timely decisions without analyzing a multitude of alternatives. This thesis analyzes 438 P-3 aviation hazard reports (hazreps) to ascertain which cognitive strategies from either the analytical or naturalistic methodology are more appropriate for handling malfunctions situations. The author presents a hybrid model of decision making by P-3 pilots based on the results of the analysis and strategies from both methodologies. This thesis recommends that decision making training be treated as a core activity of pilots not only in flight school, but alter qualification is complete. Training pilots to become experts will improve situational awareness and reduce the number of unfavorable outcomes in hazardous situations.
DTIC
Aircraft Pilots; Decision Making; Flight Training; Flight Conditions

20000073734 National Transportation Safety Board, Washington, DC USA
Safety Recommendation
Hall, Jim; Apr. 07, 2000; 19p; In English
Report No.(s): AD-A377813; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
On June 23, 1998, about 1601 eastern daylight time, a Piper PA-31 Navajo, N711LD, and Grayhawk 06, a Navy Grumman E-2, were involved in an air traffic control (ATC) operational error, which occurred about 20 miles southwest of Bradford, Pennsylvania, Both airplanes were operating on instrument flight rules (IFR) flight plans under control of the Federal Aviation Administration's (FAA) Cleveland Air Route Traffic Control Center (ARTCC) Bradford sector. Grayhawk 06 was northbound, en route from Norfolk, Virginia, to Wellsville, New York, and N711LD was westbound, en route for Elmira, New York, to Akron, Ohio.
DTIC
Air Traffic Control; Flight Safety

20000074058 Georgia Tech Research Inst., Atlanta, GA USA
Aviation Weather Information Requirements Study, *2 Jun. - 18 Nov. 1999*
Keel, Byron M., Georgia Tech Research Inst., USA; Stancil, Charles E., Georgia Tech Research Inst., USA; Eckert, Clifford A., Georgia Tech Research Inst., USA; Brown, Susan M., Georgia Tech Research Inst., USA; Gimmestad, Gary G., Georgia Tech Research Inst., USA; Richards, Mark A., Georgia Tech Research Inst., USA; June 2000; 178p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS1-99073; RTOP 577-40-10-01
Report No.(s): NASA/CR-2000-210288; NAS 1.26:210288; GTRI-A-5990; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
The Aviation Safety Program (AvSP) has as its goal an improvement in aviation safety by a factor of 5 over the next 10 years and a factor of 10 over the next 20 years. Since weather has a big impact on aviation safety and is associated with 30% of all aviation accidents, Weather Accident Prevention (WxAP) is a major element under this program. The Aviation Weather Information (AWIN) Distribution and Presentation project is one of three projects under this element. This report contains the findings of a study conducted by the Georgia Tech Research Institute (GTRI) under the Enhanced Weather Products effort, which is a task under AWIN. The study examines current aviation weather products and there application. The study goes on to identify deficiencies in the current system and to define requirements for aviation weather products that would lead to an increase in safety. The study

also provides an overview the current set of sensors applied to the collection of aviation weather information. New, modified, or fused sensor systems are identified which could be applied in improving the current set of weather products and in addressing the deficiencies defined in the report. In addition, the study addresses and recommends possible sensors for inclusion in an electronic pilot reporting (EPIREP) system.

Author

Accident Prevention; Aircraft Accidents; Flight Safety; Information Dissemination; Aircraft Safety; Weather

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications; Spacecraft Communications, Command and Tracking, and 32 Communications and Radar.

20000072443 NASA Goddard Space Flight Center, Greenbelt, MD USA

The DORIS Data Center at the CDDIS

Noll, Carey E., NASA Goddard Space Flight Center, USA; Dube, Maurice, Raytheon Co., USA; [2000]; 5p; In English; DORIS Days 2000 Symposium, 2-3 May 2000, Toulouse, France; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The DORIS system (Doppler Orbitography and Radio positioning Integrated by Satellite) was designed and developed by CNES, the National Geographic Institute, IGN (Institut G6ographique National), and the Space Geodesy Research Group, GRGS (Groupe de Recherches de Geodesie Spatiale - CNES/CNRS/Universite Paul Sabatier) to meet new needs for the precise determination of satellite positions on their orbits and for precise positioning of terrestrial beacons. This system has been carried since 1990 on the French SPOT 2 satellite, since 1992 on the French/American satellite TOPEX/POSEIDON, and since 1998 on the French SPOT 4 satellite. It will be part of the JASON (CNES/NASA) and ENVISAT (ESA) altimetric missions and also the SPOT follow-on Earth observation missions. DORIS is a radio-electrical system which takes Doppler measurements between a satellite in low orbit and a permanent global network for the purpose, on the one hand, of determining the satellite's position in orbit, and on the other hand, of locating ground beacons with a high degree of precision.

Author

Earth Observations (From Space); French Satellites; Positioning

20000074068 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Deployment of Autonomous GPS Stations in Marie Byrd Land, Antarctica

Donnellan, Andrea, Jet Propulsion Lab., California Inst. of Tech., USA; Luyendyk, Bruce, California Univ., USA; Rebold, Thomas, Jet Propulsion Lab., California Inst. of Tech., USA; Awaya, Henry, Jet Propulsion Lab., California Inst. of Tech., USA; Nesbit, William, Antarctic Support Associates, USA; Dace, Gregory, Acumen Instruments Corp., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

During the 1998-1999 Antarctic field season, we installed three autonomous GPS stations in Marie Byrd Land, West Antarctica to measure glacio-isostatic rebound and rates of spreading across the West Antarctic Rift System. The systems collect data throughout the entire year and therefore must function during the warm, relatively mild summer, and cold, harsh winters. They are powered by gel cell batteries that are charged by wind and solar power. The system includes dual data logging capability. We log data at 5 minute intervals within the receiver and at 30 second intervals to a serial data logger. We do not require 365 days of continuous data for well determined crustal velocities, but rather long periods (greater than 24 hours) of continuous data distributed throughout the year. Therefore, for simplicity, we designed the system to accept occasional data interruptions. The batteries, in addition to supplying power, act as a thermal capacitive heat storage device to help regulate the temperatures within the system. This storage system absorbs the majority of the 10-15 watts of power from the receiver and 5 watts from the data logger which helps to maintain temperature for long periods of time. Power is switched off when the temperature within the system enclosure reaches 50'C and is reconnected at 20 C. If battery voltage drops too low the batteries will freeze. Therefore, we cut the power off when the batteries drop to a low voltage of 12.45V. Power is restored at 13.2V. The temperature and power hysteresis allows for a minimum of several days of data to be collected before system shutdowns. A check of all three stations in late January 1999 indicated that the thermal and power control systems are performing as expected. We plan to implement satellite telemetry to the systems during the 2000-2001 season following a year of development.

Author

Antarctic Regions; Autonomy; Global Positioning System; Solar Generators

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.

20000069005 Arizona State Univ., Mechanical and Aerospace Engineering, Tempe, AZ USA
Development of a Composite Tailoring Procedure for Airplane Wings *Final Report*
Chattopadhyay, Aditi, Arizona State Univ., USA; [2000]; 113p; In English
Contract(s)/Grant(s): NAG2-908; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The quest for finding optimum solutions to engineering problems has existed for a long time. In modern times, the development of optimization as a branch of applied mathematics is regarded to have originated in the works of Newton, Bernoulli and Euler. Venkayya has presented a historical perspective on optimization in [1]. The term 'optimization' is defined by Ashley [2] as a procedure "...which attempts to choose the variables in a design process so as formally to achieve the best value of some performance index while not violating any of the associated conditions or constraints". Ashley presented an extensive review of practical applications of optimization in the aeronautical field till about 1980 [2]. It was noted that there existed an enormous amount of published literature in the field of optimization, but its practical applications in industry were very limited. Over the past 15 years, though, optimization has been widely applied to address practical problems in aerospace design [3-5]. The design of high performance aerospace systems is a complex task. It involves the integration of several disciplines such as aerodynamics, structural analysis, dynamics, and aeroelasticity. The problem involves multiple objectives and constraints pertaining to the design criteria associated with each of these disciplines. Many important trade-offs exist between the parameters involved which are used to define the different disciplines. Therefore, the development of multidisciplinary design optimization (MDO) techniques, in which different disciplines and design parameters are coupled into a closed loop numerical procedure, seems appropriate to address such a complex problem. The importance of MDO in successful design of aerospace systems has been long recognized. Recent developments in this field have been surveyed by Sobieszczanski-Sobieski and Haftka [6].
Derived from text
Wings; Design Analysis; Multidisciplinary Design Optimization; Structural Analysis; Aeroelasticity; Aerodynamics

20000069006 NASA Ames Research Center, Moffett Field, CA USA
Meteorological and Remote Sensing Applications of High Altitude Unmanned Aerial Vehicles
Schoenung, S. M., Longitude 122 West, Inc., USA; Wegener, S. S., NASA Ames Research Center, USA; [1999]; 8p; In English; 4th; 21st; International Airborne Remote Sensing, 21-24 Jun. 1999, Ottawa, Ontario, Ottawa, Ontario, Canada, Canada
Contract(s)/Grant(s): RTOP 529-10-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Unmanned aerial vehicles (UAVs) are maturing in performance and becoming available for routine use in environmental applications including weather reconnaissance and remote sensing. This paper presents a discussion of UAV characteristics and unique features compared with other measurement platforms. A summary of potential remote sensing applications is provided, along with details for four types of tropical cyclone missions. Capabilities of platforms developed under NASA's Environmental Research Aircraft and Sensor Technology (ERAST) program are reviewed, including the Altus, Perseus, and solar- powered Pathfinder, all of which have flown to over 57,000 ft (17 km). In many scientific missions, the science objectives drive the experimental design, thus defining the sensor payload, aircraft performance, and operational requirements. Some examples of science missions and the requisite UAV / payload system are given. A discussion of technology developments needed to fully mature UAV systems for routine operational use is included, along with remarks on future science and commercial UAV business opportunities.
Author
Experiment Design; Payloads; Pilotless Aircraft; Remote Sensing; Weather

20000069029 Naval Academy, Annapolis, MD USA
Non-Invasive Detection of CR-46 AFT Gearbox Faults Using Digital Pattern Recognition and Classification Techniques
Rex, Bryan D.; May 05, 1999; 44p; In English
Report No.(s): AD-A376843; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Currently, the USA Navy performs routine intrusive maintenance on CH-46 helicopter gearboxes in order to diagnose and correct possible fault condition. (incipient fault) which could eventually lead to gearbox failure. This type of preventative maintenance is costly and it decreases mission readiness by temporarily grounding usable helicopter. Non-invasive detection of these fault conditions would save tine and prove cost-effective in both manpower and materials. This research deals with the development of a non-invasive fault detector through a combination of digital signal processing and artificial neural network (ANN)

technology. The detector will classify incipient faults based on real-tine vibration data taken from the gearbox itself. Neural networks are systems of interconnected units that are trained to compute a specific output as a non-linear function of their inputs. For sons tine the USA Navy has been interested in the use of artificial neural networks in monitoring the health of helicopter gearboxes. In order to determine the detection sensitivity of this method in comparison with traditional invasive methods, the USN funded Westland Helicopters Ltd to conduct a series of CH-46 gearbox rig tests. In these tests, the gearbox was seeded with nine different fault conditions. This seeded fault testing provided the vibration data necessary to develop and test the feasibility of en artificial neural network for fault classification. This research deals with the formation of the pattern vectors to be used in the neural network classifier, the construction of the classification network, and an analysis of results.
DTIC
Neural Nets; Signal Processing; Digital Systems; Transmissions (Machine Elements); CH-46 Helicopter

20000069036 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Joint Strike Fighter Acquisition: Development Schedule Should Be Changed to Reduce Risks
May 2000; 32p; In English; Report to the Chairman, Subcommittee on National Security, Veterans' Affairs, and International Relations, Committee on Government Reform, House of Representatives.
Report No.(s): AD-A376878; GAO/NSIAD-00-74; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    The Joint Strike Fighter Program is intended to produce an affordable, next-generation aircraft to replace the Department of Defense's (DOD) aging aircraft inventory. The first aircraft deliveries are scheduled to begin in 2008. As currently planned, the program will cost about $200 billion to develop and procure over 3,000 aircraft and related support equipment for the Air Force, the Marine Corps, the Navy, and Great Britain. DOD has designated the Joint Strike Fighter Program as a flagship program for acquisition. to date, the program has awarded contracts totaling over $2 billion to Boeing and Lockheed Martin for the current concept demonstration phase. Under these contracts, both contractors will build the aircraft they plan to fly in the demonstration phase and also design the aircraft they plan to build in the next phase of the development program engineering and manufacturing development. During engineering and manufacturing development, the Joint Strike Fighter will be fully developed, engineered, designed, fabricated, tested, and evaluated to demonstrate that the production aircraft will meet stated requirements. DOD is scheduled to award the contract for engineering and manufacturing development to either Boeing or Lockheed Martin in April 2001.1 At your request, we reviewed the Joint Strike Fighter Program to (1) provide information on the acquisition strategy and (2) to determine whether the strategy is being implemented in a manner that will ensure that the acquisition strategy objectives will be achieved. The General accounting Office discussed a draft of this report during a March 16, 2000 joint hearing by the Subcommittees on Military Procurement and on Military Research and Development, House Committee on Armed Services. At the time of the hearing. GAO had not received DOD's comments on our report. This report contains DOD's comments and GAO's evaluation of these
DTIC
Aircraft Design; Military Technology; Product Development; Procurement; Manufacturing; Fighter Aircraft

20000069037 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Defense Acquisitions: Decisions on the Joint Strike Fighter Will Be Critical for Acquisition Reform
May 10, 2000; 22p; In English; Testimony before the Subcommittee on National Security, Veterans Affairs, and International Relations, Committee on Government Reform, House of Representatives.
Report No.(s): AD-A376882; GAO/T-NSIAD-00-173; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    This General Accounting Office report discusses the application of best commercial practices to Department of Defense weapon acquisitions in general and to the Joint Strike Fighter in particular. After having done hundreds of reviews of major weapon acquisitions over the last 20 years, GAO has seen many of the same problems recur-cost increases, schedule delays, and performance problems. Over the last 4 years, GAO has undertaken a body of work to examine weapon acquisition issues from a different, more cross-cutting perspective. Specifically, GAO has examined the best product development practices of leading commercial firms. Collectively, its reviews have included the practices of over 20 leading commercial firms that represent a variety of industries, including electronics, satellite communications, automotive, medical, and aircraft. Leading commercial firms are getting the kind of results that DOD seeks: more sophisticated products developed in less time and cost than their predecessors. GAO's work shows that DOD can learn valuable lessons from the commercial sector to get better and more predictable outcomes from weapon system development programs. DOD has taken steps to reflect best commercial practices in its acquisition policies. However, the real test of these policies is in how they influence individual decisions, such as the upcoming engineering and manufacturing development decision on the Joint Strike Fighter program. This program is to produce three fighter variants to meet multiservice requirements: conventional flight for the Air Force, short take-off and landing for the Marine Corps, and

carrier operations for the Navy. The program will also provide aircraft to the British royal Navy and Air Force. As currently planned, the program will cost about $200 billion to develop and procure over 3,000 aircraft and related support equipment.
DTIC
Congressional Reports; Defense Program; Weapon Systems; Manufacturing; Fighter Aircraft; Decision Making

20000069647 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
Improvement and Validation of the Computational Aeroelasticity Code ENS3DAE *Final Report, 4-7 Jan. 1999*
Hawkinson, Dean; Sep. 1999; 17p; In English
Contract(s)/Grant(s): Proj-2401
Report No.(s): AD-A377584; AFRL-VA-WP-TR-1999-3086; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
   The heightened awareness of the importance of fluid-structures interaction has lead to the development of several tools for addressing such issues. One continually developing tool, ENS3DAE has been adopted for use by several researchers and engineers. In the interest of increased generality, additional capabilities have been implemented into the software. of these new improvements, the ability to generate a static aeroelastic solution to a two-dimensional airfoil problem using different grid topologies has been successfully completed. Originally written to use H-type grids, ENS3DAE was not able to aeroelastically deflect the two degree of freedom airfoil. After small logic modifications and adjusting a standard input file, a reasonable static aeroelastic solution was obtained. Future plans include validation of the current work and development of a dynamic aeroelastic, pitch and plunge case for the NACA airfoil.
DTIC
Aeroelasticity; Airfoils; Computer Programs

20000069840 Federal Aviation Administration, Washington, DC USA
Airworthiness Certification of Aircraft and Related Products. Order 8130.2D
Sep. 30, 1999; 274p
Report No.(s): PB2000-103115; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche
   This order establishes procedures for accomplishing original and recurrent airworthiness certification of aircraft and related products. The procedures contained in this order apply to both Aircraft Certification Manufacturing and Flight Standards Airworthiness Aviation Safety Inspectors, and to private persons/organizations delegated authority to issue airworthiness certificates and related approvals.
NTIS
Certification; Aircraft Reliability; Flight Safety

20000069844 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
VMCA Flight Test of the Carrier-Landin', Mail-Hauling' C-2A
Wagner, Mike; Webb, Chuck; Apr. 14, 2000; 23p; In English
Report No.(s): AD-A377905; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
   The C-2A is a Navy, carrier-based aircraft used for the Carrier On-Board Delivery (COD) mission. The aircraft was recently equipped with an L-Probe pitot-static system. Comparison of L-Probe data with previous pitot-static data suggested that approach speeds might be below published Vmc. Analysis of original Vmc flight test suggested that actual Vmc had not been reached. Also, more mission representative Vmc techniques developed in recent years, could provide a more accurate Vmc number. Flight tests were conducted to reassess Vmc using the L-probes as the primary pitot-Static source. Vmc tests were conducted in 10 flights, 23 hours and included over 40 actual engine shutdowns. Both the Classic (FTM-103) and Waveoff techniques were used during the flight test. The techniques were conducted at intermediate airspeed ranges for comparative purposes. Both techniques required additional analysis and clarification to ensure minimal airspeed change from the time the engine was secured to the time initial control inputs were made and subsequent. Several other techniques/test conditions were employed to ensure a more conservative Vmc number and proper mission relation. Finally, new airspeed data evaluation considerations helped provide final Vmc numbers for fleet use. The lower Vmc number will permit approach to landings over a broader weight range. The C-2A Vmc test effort not only yielded new, more accurate Vmc numbers for the C-2A aircraft, it also yielded many lessons learned that will be of assistance to future Vmc testers.
DTIC
Transport Aircraft; Aircraft Carriers

20000069848 General Accounting Office, National Security and International Affairs Div., Washington, DC USA

Defense Acquisitions: F/A-18E/F Aircraft Does Not Meet All Criteria for Multilayer Procurement

Kuhta, Steven; May 2000; 29p; In English

Report No.(s): AD-A377914; GAO/NSIAD-00-158; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Although the F/A-18E/F met its key performance parameters, such as range and carrier suitability, the operational testers' comparisons of the F/A-l8E/F to the existing F/A-18C showed that the F/A-18E/F did not demonstrate superior operational performance over the existing F/A-18C aircraft. The testers compared the operational effectiveness of the F/A-18C6 to the F/A-18E/F in 18 operational mission areas such as interdiction, fighter escort, combat air patrol, air combat maneuvering, and air-to-air weapons. Using a numerical scale, the testers rated the F/A-18E/F's operational effectiveness essentially the same as the F/A-18C's.

DTIC

System Effectiveness; F-18 Aircraft; Maneuvers; Procurement

20000069862 Army War Coll., Carlisle Barracks, PA USA

Teaching a New Dog Old Tricks: Replacing Man with Artificial Intelligence in Combat Aircraft

Flade, John W.; Apr. 01, 2000; 36p; In English

Report No.(s): AD-A377623; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

By 2025 the U.S. is counting on the Joint Strike Fighter (JSF) to be the backbone of its offensive aerial arm. JSF, with a service life of 40 to 50 years, is expected to replace the F-16 and A-10 in the USAF-inventory. For the U.S. Marine Corps, JSF will take the place of the AV-8 and F-18. The U.S. Navy needs JSF for long range strike as a replacement for the F-14 and F-18. All told, the U.S. intends to buy a stupendous number of JSFs-nearly 3,000 aircraft! Yet, increasing computer power affords the U.S. the option of replacing manned strike aircraft with an uninhabited combat aerial vehicle (UCAV). Without a pilot, the UCAV offers tremendous increases in lethality and survivability. The enhanced effectiveness of modern air defense systems, coupled with the high cost of crewed aircraft and the increasing value placed on human life is forcing the adoption of unmanned aerial vehicles for the combat role. This paper takes the position that at the current pace of technological advancement the UCAV will provide the USA with a cornerstone combat capability far exceeding that of the JSF by 2016. UCAV capacity will render JSF obsolete far ahead of its service life.

DTIC

Fighter Aircraft; Pilotless Aircraft; Artificial Intelligence; Automatic Flight Control

20000070332 Naval Postgraduate School, Monterey, CA USA

Full Nonlinear Simulation of Helicopter Coupled Rotor-Fuselage Motion Using MATLAB Symbolic Processor and Dynamic Simulation

Weissenfels, Robert D.; Mar. 2000; 111p; In English

Report No.(s): AD-A377881; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This thesis formulates the full nonlinear equations of motion for determining the stability of helicopter coupled rotor-fuselage motion utilizing MATLAB(registered)'s Symbolic Math Toolbox. Using the extended symbolic processor toolbox, the goal of this work was to eliminate the time consuming process of convening FORTRAN or C code generated by the symbolic processor, MAPLE(registered) into a MATLAB(registered) useable format where it is further incorporated into an

DTIC

Equations of Motion; Fuselages; Applications Programs (Computers); Rotary Wings

20000070448 Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA

An Enhanced Multi-Objective Optimization Technique for Comprehensive Aerospace Design, *15 Jul. 1998 - 14 Jan. 2000*

Chattopadhyay, Aditi, Arizona State Univ., USA; Rajadas, John N., Arizona State Univ., USA; [2000]; 28p; In English

Contract(s)/Grant(s): NCC2-1000; NCC2-5150; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An enhanced multiobjective formulation technique, capable of emphasizing specific objective functions during the optimization process, has been demonstrated on a complex multidisciplinary design application. The Kreisselmeier-Steinhauser (K-S) function approach, which has been used successfully in a variety of multiobjective optimization problems, has been modified using weight factors which enables the designer to emphasize specific design objectives during the optimization process. The technique has been implemented in two distinctively different problems. The first is a classical three bar truss problem and the second is a high-speed aircraft (a doubly swept wing-body configuration) application in which the multiobjective optimization procedure simultaneously minimizes the sonic boom and the drag-to-lift ratio (C_D/C_L) of the aircraft while maintaining the lift

coefficient within prescribed limits. The results are compared with those of an equally weighted K-S multiobjective optimization. Results demonstrate the effectiveness of the enhanced multiobjective optimization procedure.
Author
Procedures; Aerospace Engineering; Body-Wing Configurations

20000070474 Smart Material Design, Inc., Highland Park, IL USA
Quantitative Nondestructive Evaluation and Reliability Assessment of the Aging Aircraft Structure Components *Final Report, 1 Aug. 1999-31 Jan. 2000*
Sutin, Alexander, Smart Material Design, Inc., USA; Apr. 30, 2000; 114p; In English
Contract(s)/Grant(s): F49620-99-C-0038
Report No.(s): AD-A377667; AFRL-SR-BL-TR-00-0188; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy
　　The report developed under STTR contract presents the results of work performed on development of a new probabilistic model for reliability assessment of the aging aircraft structural components and nonlinear acoustic instrumentation for collecting the input data for reliability model. The reliability of aging components is estimated on the basis of crack propagator concept CP (probability of crack extension from one position to the next during specified time interval). Monte Carlo Simulation is employed for numerical realization. parameters of CP can be evaluated and experimentally verified by nonlinear acoustic technique and instrumentation. This instrumentation uses the interaction of ultrasonic waves with vibration (Nonlinear Elastic Wave Spectroscopy - NEWS). High sensitivity of nonlinear acoustic technique for crack detection and location was demonstrated for different class of materials: polycarbonate, steel, aluminum, adhesive bonded aluminum plates. This technique allows to estimate crack size and location that are the input parameters for the reliability model. Draft design of the instrumentation has been also developed. Phase II will pursuer advanced development of reliability model. The stationary and in-field usage nonlinear instrumentation prototypes and software will be developed for lifetime and quantitative reliability assessment of the aging structure components.
DTIC
Aircraft Structures; Nondestructive Tests; Reliability Analysis; Structural Design; Mathematical Models

20000070484 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands
Design, Fabrication and Testing of a Dyneema/Polyethylene Radome for Airborne Remote Sensing
deVries, H. P. J.; Jan. 07, 1998; 20p; In English; SAMPE/JEC Conference, Apr. 1998, Paris, France
Report No.(s): PB2000-104892; NLR-TP-98005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
　　Most radomes consist of a solid laminate or sandwich type structure made of fiberglass reinforced plastics. The use of Dyneema (trademark of DSM) fibers in a plyethylene (PE) matrix instead of fiberglass reinforced plastics for radomes is very interesting because of excellent radar transparency of Dyneema/PE. However, because of its sensitivity for creep, applications in aerodynamically loaded structures are limited. The key problems facing their use in radomes are how to improve the mechanical properties to an acceptable level and how to mount the radome on the radar pod. This paper presents the development of a Dyneema/PE radome for airborne remote sensing. Several electrical properties and design aspects of the radome are discussed. The effect of the consolidation conditions on the creep behavior and the configuration of the mounting system are described. Test flight results are evaluted.
NTIS
Fabrication; Radomes; Remote Sensing; Composite Materials; Polyethylenes; Sandwich Structures

20000070485 National Aerospace Lab., Structures and Materials Div., Amsterdam, Netherlands
Impact Energy Absorbing Surface Layers for Protection of Composite Aircraft Structures
Hart, W. G. J.; Ubels, L. C.; Jan. 07, 1998; 24p; In English; Composite Materials, ECCM-8, 3-6 Jun. 1998, Naples, Italy
Report No.(s): PB2000-104893; NLR-TP-98002; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
　　In the framework of a European Defense Research Program the NLR investigated how the tolerance behavior of carbon/epoxy composite aircraft structures can be improved by application of impact energy absorbing surface layers. A promising concept of protection layers consist of a layer of an adhesive filled with glass microballoons covered with one or more layers of aluminum gauze. In an experimental test program on unprotected and protected stiffened compression panels it was proved that surface layers may prevent impact damage in the composite panel for impact energies up to 60 Joule. As compared to an unprotected component the compression failure load was increased by approximately 40 T. This benefit has to be set off against a weight penalty of 26%.
NTIS
Aircraft Structures; Composite Structures; Epoxy Matrix Composites; Shock Absorbers; Impact Resistance; Impact Damage

20000070743 Stanford Univ., Edward L. Ginzton Lab. of Physics, Stanford, CA USA

Aging Aircraft NDE With Micromachined Ultrasonic Air Transducers *Final Report, 1 Mar.-30 Sep. 1999*

Khuri–Yakub, Butrus T.; Apr. 2000; 9p; In English

Contract(s)/Grant(s): F49620-99-1-0137; AF Proj. 2306

Report No.(s): AD-A377646; AFRL-SR-BL-TR-00-0186; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Due to the large impedance mismatch between common piezoelectric materials and air, conventional piezoelectric transducers are not very efficient sources of ultrasound in air. Therefore, piezoelectric nondestructive evaluation (NDE) systems must use a coupling fluid to improve the power transfer to the sample. Use of a coupling fluid or immersion of the sample complicates inspection, and in some cases is undesirable. Air-coupled ultrasonic systems are preferable as long as efficient transducers are available for transferring ultrasound into air. This report discusses some capacitive micro machined ultrasonic transducers (CMUTs) that have more than 100 dB 113 dynamic range in a bistatic transmission system. These transducers consist of thousands of 1 (m-thick silicon-nitride membranes, resonating at 2-3 MHz electrically connected in parallel. Equivalent circuit modeling of the transducers provides insight into the design of the devices and enables accurate predictions of CMUTs' behavior in NDE systems. Finally, the report concludes with some discussion of current research in developing efficient, wide-band CMUTs.

DTIC

Nondestructive Tests; Ultrasonics; Ultrasonic Wave Transducers; Piezoelectric Transducers

20000072429 Naval Undersea Warfare Center, Newport, RI USA

Unmanned Vehicle Initiatives to Expand the USW Battlespace

Ricci, Vittorio; Lisieqicz, John S.; Mar. 21, 2000; 12p; In English

Report No.(s): AD-A377668; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper discusses the current development challenges and unmanned vehicle technology demonstrations for two on-going unmanned vehicle initiatives for expanding the battlespace for USW: MANTA unmanned undersea vehicles (UUV's) and SPARTAN unmanned surface vehicles (USV's). Modular payload designs common to both UUV and USV efforts enable rapid reconfiguration for numerous missions including ASW, ISR, SSTD, counter-SOF, MIW, cruise missile defense, etc. while the SPARTAN USV is envisioned as a high-speed, long endurance platform performing operations after hostilities break out, the MANTA UUV capitalizes on endurance in clandestine operations performed during the pre-hostilities phase. Operation synergy is gained with acoustic communications (ACOMMS) which would permit subsurface forces to remain clandestine for the duration of the mission. The modular MANTA technology test bed offers reduced operating cost, supports large size payloads, and provides extended operation using low cost energy sources. Both MANTA and SPARTAN will be primary asymmetric force levelers enabling the battle force commander to match inexpensive threat capability with an appropriate response. Inherent netcentricity increases USW effectiveness by providing expanded sensor coverage in areas where other assets are difficult to deploy or where risk to manned platforms is unacceptable.

DTIC

Remotely Piloted Vehicles; Underwater Vehicles; Surface Vehicles

20000072475 General Accounting Office, National Security and International Affairs Div., Washington, DC USA

Unmanned Aerial Vehicles: Progress of the Global Hawk Advanced Concept Technology Demonstration

Ward, Charles; Strittmatter, Richard; McGuire, Michael; Apr. 2000; 15p; In English; Report to Congressional Committees.

Report No.(s): AD-A376992; GAO/NSIAD-00-78; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Department of Defense (DOD) has built five prototype Global Hawk reconnaissance aircraft for use in a High Altitude Endurance Unmanned Aerial Vehicle Advanced Concept Technology Demonstration. The Advanced Concept Technology Demonstration's purpose is to determine through design and construction of Global Hawk prototypes, and a subsequent assessment of their utility in military user demonstrations, if the concept is effective as an Air Force reconnaissance aircraft before DOD decides whether to acquire a production version of it. Reconnaissance aircraft such as Global Hawk are used to obtain information about the activities and resources of enemy forces. If DOD decides to acquire Global Hawk, the production version is expected to provide the Air Force with the ability to fly for 40 continuous hours and conduct reconnaissance for up to 24 hours at a radius of 3,000 nautical miles. In 1994, when the Advanced Concept Technology Demonstration was initiated, DOD established a $10-million average unit flyaway price goal in fiscal year 1994 dollars for air vehicles numbered 11 through 20.2 The unit flyaway price covers the cost of the vehicle, its reconnaissance sensors, and the contractor's fee. Unit flyaway price excludes costs for systems engineering and program management, system test and evaluation and non-recurring tooling, engineering and manufacturing development, and non-flying support equipment such as the ground control station.

DTIC

Pilotless Aircraft; Aerial Reconnaissance; Reconnaissance Aircraft; Systems Engineering; Manufacturing

20000072476 Department of Defense, Office of the Inspector General, Arlington, VA USA
Environmental Consequence Analyses for the V-22 Osprey Program
Reed, Donald E.; Rau, Russell A.; Hopkins, Wanda A.; Snider, Jack D.; Lowe, Alvin B.; Mar. 29, 1993; 29p; In English
Report No.(s): AD-A376997; IG/DOD-93-077; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
　　The audit objectives were to evaluate the effectiveness of DoD environmental consequence analyses of major Defense acquisition programs and to assess compliance with provisions of the National Environmental Policy Act of 1969 and internal controls related to the objectives. The V-22 Osprey was one program in the audit of the Effectiveness of DoD Environmental Consequence Analyses of Major Defense Acquisition Programs.
DTIC
Helicopters; V-22 Aircraft; Environment Management

20000072478 Federal Aviation Administration, Office of Aviation Research, Washington, DC USA
Flammability of Aircraft Insulation Blankets Subjected to Electrical Arc Ignition Sources
Cahill, P.; Apr. 2000; 20p; In English
Report No.(s): PB2000-105920; DOT/FAA/AR-TN00/20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
　　In the fall of 1998, the Federal Aviation Administration (FAA) initiated a program of intense testing, i.e., full-scale testing, intermediate testing, bench-scale testing, and electrical ignition testing on thermal acoustical insulation. This work was prompted by several factors related to current fire test requirements, including the crash of the Swissair MD-11 off the coast of Canada, and the failure of an industry fire test standard called the cotton swab test to characterize the flammability characteristics of a certain foam and fiberglass cover material. The thermal acoustical insulation films tested in this program were polyimide, metallized and nonmetallized polyester polyimide, metallized and nonmetallized polyester poly (ethylene terethalate) (PET) and metallized poly (vinyl fluoride) (PVF). The test blankets were subjected to 115- and 208-volt electrical arcing test. This same testing was performed on these blankets with a corrosion inhibiting compound (CIC) sprayed on them.
NTIS
Electric Arcs; Flammability; Glass Fibers; Thermal Insulation; Aircraft Industry; Full Scale Tests

20000072501 Naval Postgraduate School, Monterey, CA USA
AH-64 Apache Cost Reduction
Short, Daniel R.; Mar. 2000; 125p; In English
Report No.(s): AD-A377413; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
　　The Total Ownership Cost Reduction (TOCR) Program was implemented to assist the Program Manager (PM) in upgrading components with significant life-cycle costs. Neither a formal database tracking system for corrosion nor a funded program for updating corrosion-susceptible parts exists. In 1996, at Hunter Army Airfield, Georgia, replacement of corroded gearboxes on the AH-64A Apache Helicopter accounted for $1.12M, yet went unnoticed due to the lack of a comprehensive database. The Apache PM experiences difficulty in taking full advantage of the TOCR program because of application and funding uncertainties. Corrosion of the Apache's driveline components merits overhaul-procedure modifications under the TOCR program. However, the lack of database tracking and inadequate TOCR program funding discourage PM use. This thesis researches component database tracking and TOCR funding to facilitate the PMs reduction of the Apache's life-cycle costs.
DTIC
AH-64 Helicopter; Cost Reduction; Life Cycle Costs; Aircraft Maintenance

20000073286 Department of Defense, Office of the Inspector General, Arlington, VA USA
Acquisition of Unmanned Aerial Vehicles
Reed, Donald E.; Meling, John E.; Wyte, David M.; Stockton, Donald N.; May 27, 1993; 63p; In English
Report No.(s): AD-A376754; IG/DOD-93-102; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
　　The audit objective was to evaluate the overall management of the UAV acquisition programs included in the calendar year 1991 DoD UAV Master Plan. Specifically, the audit determined whether the Short Range, Close Range, and Medium Range UAV programs were being cost-effectively developed and readied for procurement. We also reviewed associated internal controls.
DTIC
Pilotless Aircraft; Target Acquisition; Aircraft Detection

20000073320 Department of Defense, Office of the Inspector General, Arlington, VA USA
Navy's Aircraft Structural Life Surveillance Program Data Recorders
Nov. 12, 1992; 12p; In English

Report No.(s): AD-A377461; IG/DOD-93-022; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We are providing this final report for your information and use. This audit was performed in response to a DoD Inspector General hotline allegation that the Navy's planned $188 million procurement of structural data recorders under the Navy's Aircraft Structural Life Surveillance Program duplicated existing Navy recorder systems. The recorder monitors the structural stress that an aircraft experiences during operation. Our objective was to evaluate the validity of this allegation. We also evaluated the effectiveness of applicable internal controls.

DTIC

Aircraft Structures; Life (Durability); Structural Analysis; Recorders

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

20000069028 Department of Defense, Office of the Inspector General, Arlington, VA USA

Procurement of Secondary Exhaust Seal and Secondary Exhaust Flap for the F4O4 Engine

Apr. 21, 1993; 14p; In English

Report No.(s): AD-A376806; IG/DOD-93-088; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We are providing this final report for your information and use. The audit was in response to a DoD Hotline complaint received during our audit of the procurement of spare parts and supplies (Project No. OCH-50l7). The complainant alleged that the Navy Aviation Supply Office (ASO) was avoiding competition by using an Air Force basic ordering agreement (BOA) to procure secondary exhaust seals and secondary exhaust flaps for the F4O4 engine and paying higher prices than if the procurements were competitive. The audit objectives were to determine whether ASO followed Federal and DoD acquisition regulations when procuring the secondary exhaust seal and flap, and to examine applicable internal control. We concluded that ASO followed appropriate acquisition regulations. ASO used an Air Force BOA with General Electric Aircraft Engines and competitive contracts with other sources to procure the parts. The noncompetitive procurements using the Air Force BOA were properly justified and approved. However, the prices on the noncompetitive procurements were higher than the prices on the competitive procurements. The differences in the prices paid clearly show the monetary benefits of competitive purchases of the parts.

DTIC

Seals (Stoppers); Aircraft Engines; Flapping; Flaps (Control Surfaces)

20000069804 Office of Naval Research, Mechanics and Energy Conversion S and T Div., Arlington, VA USA

Challenges and Opportunities in the Development of Pulse Detonation Engines

Roy, Gabriel D., Office of Naval Research, USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 15-23; In English; See also 20000069802; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

As longer range and fuel economy are desired of propulsion systems, research has been focused on various avenues such as energetic fuels and combustion control. Propulsion engines based on the pulse detonation cycle offer the potential of higher thermodynamic cycle efficiency, better specific thrust and reduced fuel consumption. In some cases this can be achieved with no moving parts. The simplicity of the air breathing Pulse Detonation Engine (PDE) and its potential for easier scaling extrapolates to substantial reductions in development time, when compared to conventional turbine engines. Multi-cycle, multitube detonation engines offer the potential of fluidic thrust vectoring, with low drag, and without external fins, a decisive advantage in high-speed missile propulsion. Though there is extensive literature on detonations, not much research has been undertaken to address the challenging scientific issues involved in utilizing this concept for propulsion. A number of opportunities exists for the analysts, computationalists, and experimentalists. The Office of Naval Research (ONR) initiated a five-year core research and a Multidisciplinary University Research Initiative (MURI) program in PDE for propulsion applications. The various challenges in the research and development of PDE for propulsion applications, the opportunities that arise in this pursuit, and the approach taken to enable this technology as a viable option for propulsion engines are addressed in this paper.

Author

Air Breathing Engines; Combustion Control; Detonation; Fuel Consumption; Propulsion System Performance; Pulsed Jet Engines

20000069807 National Academy of Sciences - National Research Council, Hampton, VA USA

Numerical Simulation of Dual-Mode Scramjet Combustors

Rodriguez, C. G., National Academy of Sciences - National Research Council, USA; Riggins, D. W., Tennessee Univ., USA; Bittner, R. D., FDC/NYMA, Inc., USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 47-64; In English; See also 20000069802; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

    Results of a numerical investigation of a three-dimensional dual-mode scramjet isolator-combustor flow field are presented. Specifically, the effect of wall cooling on upstream interaction and flow structure is examined for a case assuming jet-to-jet symmetry within the combustor. Comparisons are made with available experimental wall pressures. The half duct for the isolator-combustor is then modeled in order to study the influence of side walls. Large scale three-dimensionality is observed in the flow with massive separation forward on the side walls of the duct. A brief review of convergence acceleration techniques useful in dual-mode simulations is presented, followed by recommendations regarding the development of a reliable and unambiguous experimental data base for guiding CFD code assessments in this area.

Author

Combustion Chambers; Computational Fluid Dynamics; Computerized Simulation; Three Dimensional Flow; Mathematical Models; Supersonic Combustion Ramjet Engines

20000069811 NASA Ames Research Center, Moffett Field, CA USA

Theoretical Performance of Frictionless MHD-Bypass Scramjets

Park, Chul, Thermoscience Inst., USA; Bogdanoff, David, Thermoscience Inst., USA; Mehta, Unmeel B., NASA Ames Research Center, USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 103-120; In English; See also 20000069802; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

    Theoretical performance calculation is made of a scramjet propulsion system incorporating a magneto-hydro-dynamic (MHD) energy bypass scheme. The MHD generator upstream of the combustion chamber slows down the flow so that the mach number at the entrance of the combustion chamber is kept below a specified value. The MHD accelerator downstream of the combustion chamber accelerates the flow, expending the electrical power produced by the generator. The flow is seeded with potassium or cesium, and the MHD devices operate as Faraday machines. Friction is neglected, and chemical equilibrium is assumed everywhere except in the nozzle downstream of the freezing point. The calculation shows that the MHD-bypass scheme can improve specific impulse over that of a conventional scramjet at flight speeds over 3.5 kilometers per second. At speeds below about 6 km/s, the calculated specific impulse can be higher than that of a typical rocket engine. Consequently, the MHD-bypass scheme can extend the operational range or improve the performance of a conventional scramjet engine.

Author

Bypasses; Combustion Chambers; Magnetohydrodynamic Generators; Supersonic Combustion Ramjet Engines; Mathematical Models; Propulsion System Performance; Friction

20000069813 Naval Research Lab., Lab. for Computational Physics and Fluid Dynamics, Washington, DC USA

Pulsed Detonation Engines: What is Its Performance?

Kailasanath, K., Naval Research Lab., USA; Patnaik, G., Naval Research Lab., USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 131-140; In English; See also 20000069802; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

    A review of various computational studies of pulsed detonation engines shows a wide variation in the predicted performance of even an idealized system. Detailed numerical simulations are used to explore some plausible reasons for the observed differences. Simulations with several boundary conditions clearly show that the specific choice of the boundary conditions affects not only the details of the flow field but also the overall performance estimates. The initial conditions used in the simulations to initiate detonations can also significantly add to the performance estimates. The results from these studies are used to reconcile previous performance estimates.

Author

Detonation; Performance Prediction; Computerized Simulation; Rocket Engines; Computation; Pulsed Jet Engines

20000069814 Pennsylvania State Univ., Propulsion Engineering Research Center, University Park, PA USA

Multidisciplinary Study of Pulse Detonation Engine Propulsion

Santoro, R. J., Pennsylvania State Univ., USA; Broda, J. C., Pennsylvania State Univ., USA; Conrad, C., Pennsylvania State Univ., USA; Woodward, R., Pennsylvania State Univ., USA; Pal, S., Pennsylvania State Univ., USA; Lee, S.–Y., Pennsylvania State

A series of detonation experiments with ethylene/air/O2 mixtures was conducted as part of an extensive research program on air-breathing Pulse Detonation Engines (PDE's). to date, efforts have focused on the initiation and propagation of normal detonations in a 1.34-inch I.D. circular pre-detonator. Initially, single-shot experiments were carried out to obtain the required knowledge and understanding on the Deflagration to Detonation Transition (DDT) process. With the help of carefully designed obstacles, DDT was promoted in ethylene/air mixtures within two feet and in less than 3.5 ms. Based on this achievement, successful multi-cycle operation with ethylene/air and ethylene/(O2+2N2) mixtures was accomplished at frequencies reaching 8-10 Hz and 15-20 Hz respectively. The limitation with respect to the maximum operating frequencies was a result of the poor performance of the fuel solenoid valve, which is not designed to operate at the low supply pressures currently used. Minor changes in the setup should eliminate this problem and it is expected that significantly higher frequencies will be reached in the near future.
Author
Air Breathing Engines; Detonation; Deflagration; Propulsion System Performance; Pulsed Jet Engines

Performance and Thermal Modeling of a Combined Cycle PDE/Ramjet

The use of a combined cycle Pulse Detonation Engine/ramjet (PDE/ramjet) for the low-speed propulsion system in a high-speed flight vehicle is considered. The described effort consisted of extending available performance and design tools, configuring a combined cycle PDE/ramjet to meet mission requirements and predicting engine and vehicle level performance. Based on trajectory information from prior high-speed vehicle design, PDE and ramjet flaw area requirements were determined for a designated flight trajectory using PDE and ramjet performance prediction tools. Based on these requirements a combined cycle engine was configured and operating conditions were defined to meet the thrust requirement over the complete mission trajectory. Installed performance of the complete combined cycle engine from inlet to nozzle is discussed. An assessment of cooling requirements as related to the available fuel heat sink was made. Emphasis in thermal analysis was placed on cooling of the PDE.
Author
Rocket-Based Combined-Cycle Engines; Detonation; Performance Prediction; Thermal Analysis; Mathematical Models; Design Analysis; Pulsed Jet Engines; Ramjet Engines

A Simple Theoretical Maximum Performance Model for Pulsed Detonation Engines

Various models are available for predicting the performance of pulsed detonation engines (PDE's). The range of performance predicted by these models is large. Hence we propose a simple model based on the assumption of a Chapman-Jouguet detonation wave in chemical equilibrium. Additionally we assume that there are no losses within the system. This model should predict the maximum theoretical performance of such devices. The pulsed detonation engine calculation starts with a constant area tube (with or without a nozzle extension) filled with a uniform mixture of fuel and oxidizer at constant pressure. A Chapman-Jouguet detonation is assumed to start at the closed end of the tube and propagate towards the open end. A Method of Characteristics solution calculates the motion of both the detonation and rarefaction waves within the tube. The application of the outflow boundary condition outside of the PDE device treats the interaction of the detonation wave and the external atmosphere. The performance of the PDE is calculated by computing the pressure force on the closed end of the tube plus the nozzle extension until the pressure falls

below an input criterion. The specific impulse is calculated from the total impulse and the mass of the fuel and oxidizer initially in the PDE.

Author

Detonation; Detonation Waves; Mathematical Models; Pulsed Jet Engines; Performance Prediction

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also 05 Aircraft Design, Testing and Performance and 06 Avionics and Aircraft Instrumentation.

20000072424 NASA Marshall Space Flight Center, Huntsville, AL USA

Sliding Mode Control of the X-33 with an Engine Failure

Shtessel, Yuri B., Alabama Univ., USA; Hall, Charles E., NASA Marshall Space Flight Center, USA; [2000]; 18p; In English; Joint Propulsion Conference, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ascent flight control of the X-3 is performed using two XRS-2200 linear aerospike engines. in addition to aerosurfaces. The baseline control algorithms are PID with gain scheduling. Flight control using an innovative method. Sliding Mode Control. is presented for nominal and engine failed modes of flight. An easy to implement, robust controller. requiring no reconfiguration or gain scheduling is demonstrated through high fidelity flight simulations. The proposed sliding mode controller utilizes a two-loop structure and provides robust. de-coupled tracking of both orientation angle command profiles and angular rate command profiles in the presence of engine failure, bounded external disturbances (wind gusts) and uncertain matrix of inertia. Sliding mode control causes the angular rate and orientation angle tracking error dynamics to be constrained to linear, de-coupled, homogeneous, and vector valued differential equations with desired eigenvalues. Conditions that restrict engine failures to robustness domain of the sliding mode controller are derived. Overall stability of a two-loop flight control system is assessed. Simulation results show that the designed controller provides robust, accurate, de-coupled tracking of the orientation angle command profiles in the presence of external disturbances and vehicle inertia uncertainties, as well as the single engine failed case. The designed robust controller will significantly reduce the time and cost associated with flying new trajectory profiles or orbits, with new payloads, and with modified vehicles

Author

Flight Control; X-33 Reusable Launch Vehicle; Engine Failure; Angular Velocity; Aerospike Engines

20000073727 NASA Langley Research Center, Hampton, VA USA

Steady-State Computation of Constant Rotational Rate Dynamic Stability Derivatives

Park, Michael A., Joint Inst. for Advancement of Flight Sciences, USA; Green, Lawrence L., NASA Langley Research Center, USA; 2000; 20p; In English; 18th; Applied Aerodynamics, 14-17 Aug. 2000, Denver, CO, USA

Report No.(s): AIAA Paper 2000-4321; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Dynamic stability derivatives are essential to predicting the open and closed loop performance, stability, and controllability of aircraft. Computational determination of constant-rate dynamic stability derivatives (derivatives of aircraft forces and moments with respect to constant rotational rates) is currently performed indirectly with finite differencing of multiple time-accurate computational fluid dynamics solutions. Typical time-accurate solutions require excessive amounts of computational time to complete. Formulating Navier-Stokes (N-S) equations in a rotating noninertial reference frame and applying an automatic differentiation tool to the modified code has the potential for directly computing these derivatives with a single, much faster steady-state calculation. The ability to rapidly determine static and dynamic stability derivatives by computational methods can benefit multidisciplinary design methodologies and reduce dependency on wind tunnel measurements. The CFL3D thin-layer N-S computational fluid dynamics code was modified for this study to allow calculations on complex three-dimensional configurations with constant rotation rate components in all three axes. These CFL3D modifications also have direct application to rotorcraft and turbomachinery analyses. The modified CFL3D steady-state calculation is a new capability that showed excellent agreement with results calculated by a similar formulation. The application of automatic differentiation to CFL3D allows the static stability and body-axis rate derivatives to be calculated quickly and exactly.

Author

Steady State; Rotation; Dynamic Stability; Computation; Stability Derivatives; Finite Difference Theory

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see 03 Air Transportation and Safety. For astronautical facilities see 14 Ground Support Systems and Facilities (Space).

20000069805 NASA Langley Research Center, Hampton, VA USA

Test Capabilities and Recent Experiences in the NASA Langley 8-Foot High Temperature Tunnel

Hodge, J. S., NASA Langley Research Center, USA; Harvin, S. F., NASA Langley Research Center, USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 25-36; In English; See also 20000069802; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The NASA Langley 8-Foot High Temperature Tunnel (8-Ft. HTT) is a combustion-heated hypersonic blowdown-to-atmosphere wind tunnel that provides flight enthalpy simulation for Mach numbers of 4, 5, and 7 through an altitude range from 50,000 to 120,000 feet. The open-jet test section is 8-ft. in diameter and 12-ft. long. The test section will accommodate large air-breathing hypersonic propulsion systems as well as structural and thermal protection system (TPS) components. Stable wind tunnel test conditions can be provided for a duration of 60 seconds. Additional test capabilities are provided by a radiant heater system that can be used to simulate ascent or entry heating profiles. The test medium is the combustion products of air and methane that are burned in a pressurized combustion chamber. Oxygen is added to the test medium for air-breathing propulsion tests so that the test gas contains twenty one percent molar oxygen. The facility was modified extensively in the late 1980's to provide airbreathing propulsion testing capability. In this paper, a brief history and general description of the facility are presented along with a discussion of the types of testing that can be supported. Recently completed tests conducted in the 8-Ft. HTT are discussed to explain the capabilities the facility provides and to demonstrate the experience of the staff.

Author

High Temperature; Hypersonics; Wind Tunnel Tests; Aerodynamic Heating; Air Breathing Engines; Blowdown Wind Tunnels

20000069835 Air Force Research Lab., Human Effectiveness Directorate, Mesa, AZ USA

Portable Eye-Tracking System Used During F-16 Simulator Training Missions at Luke AFB: Adjustment and Calibration Procedures *Final Report, Apr. 1997 - Sep. 1998*

Wetzel, Pual A.; Anderson, Gretchen; Nov. 1998; 25p; In English; Prepared in cooperation with Raytheon Training Systems

Contract(s)/Grant(s): F41624-97-D-5000; AF Proj. 1123

Report No.(s): AD-A368304; AFRL-HE-AZ-TP-1998-0111; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A portable eye-tracking system has been employed at Luke Air Force Base, AZ, for use during F-16 B-course simulator training missions. Proper headband adjustment and accurate calibration of the eye-tracking system allows the instructor to see exactly where the student is looking throughout the training mission. This paper describes the components of; and the correct adjustment procedures for, the Elmar Vision 2000 system. These procedures were developed in order to allow the system to successfully be transitioned to the user; namely, the simulator operator.

DTIC

Training Simulators; Flight Training; Flight Simulation; Tracking (Position)

20000069852 Army Research Lab., Sensors Directorate, Adelphi, MD USA

Design and Test of a Prototype Acoustic High-Intensity Infrasonic Test Chamber

Boesch, H. E., Jr.; Benwell, Bruce T.; Reiff, Christian G.; Apr. 2000; 38p; In English

Contract(s)/Grant(s): Proj-A140

Report No.(s): AD-A377759; ARL-TR-2137; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe the conception, design, mathematical modeling, construction, and test of a prototype acoustic test chamber intended to support the performance of high-intensity acoustic target-effects experiments on large targets at infrasonic frequencies. In initial experiments, the test chamber produced continuous sinusoidal sound pressure levels in excess of 140 dB over a frequency range of 5 to 20 Hz within a test volume of 5 cubic m.

DTIC

Structural Design; Test Chambers

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see categories 13 through 20. For extraterrestrial exploration, see 91 Lunar and Planetary Science and Exploration.

20000068537 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Deep Space Control Challenges of the New Millennium

Bayard, David S., Jet Propulsion Lab., California Inst. of Tech., USA; Burdick, Garry M., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 2p; In English; 7th; 7th MED99 Mediterranean Conference on Control and Automation, 28-30 Jun. 1999, Haifa, Israel; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The exploration of deep space presents a variety of significant control challenges. Long communication delays coupled with challenging new science objectives require high levels of system autonomy and increasingly demanding pointing and control capabilities. Historically, missions based on the use of a large single spacecraft have been successful and popular since the early days of NASA. However, these large spacecraft missions are currently being displaced by more frequent and more focused missions based on the use of smaller and less expensive spacecraft designs. This trend drives the need to design smart software and good algorithms which together with the miniaturization of control components will improve performance while replacing the heavier and more expensive hardware used in the past. NASA's future space exploration will also include mission types that have never been attempted before, posing significant challenges to the underlying control system. This includes controlled landing on small bodies (e.g., asteroids and comets), sample return missions (where samples are brought back from other planets), robotic exploration of planetary surfaces (e.g., intelligent rovers), high precision formation flying, and deep space optical interferometry, While the control of planetary spacecraft for traditional flyby and orbiter missions are based on well-understood methodologies, control approaches for many future missions will be fundamentally different. This paradigm shift will require completely new control system development approaches, system architectures, and much greater levels of system autonomy to meet expected performance in the presence of significant environmental disturbances, and plant uncertainties. This paper will trace the motivation for these changes and will layout the approach taken to meet the new challenges. Emerging missions will be used to explain and illustrate the need for these changes.

Author

Autonomy; Deep Space; Space Exploration; Spacecraft Control; NASA Space Programs

20000069864 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA

Proceedings of the 2000 Space Control Conference

Andrews, S. E.; Apr. 13, 2000; 193p; In English; Proceedings of the 2000 Space Control Conference held 11-13 April 2000 held at Lincoln Labs, Hanscom AFB.

Contract(s)/Grant(s): F19628-95-C-0002

Report No.(s): AD-A377625; STK-255; ESC-TR-99-063; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

The eighteenth Annual Space Control Conference was held on 11, 12, and 13 April 2000. ESC acts as administrative sponsor of the event which is held at the Lincoln Laboratory facility on Hanscom AFB, and the program is coordinated with Air Force Space Command and the Air Force Research Laboratory. The purpose of this series of conferences is to provide a forum for the presentation and discussion of space control issues. This Proceedings documents those presentations from this conference that were received in time for pre-conference publication. The papers contained were reproduced directly from copies supplied by their authors (with minor mechanical changes where necessary). It is hoped that this publication will enhance the utility of the conference.

DTIC

Conferences; Space Surveillance (Spaceborne); Aerospace Environments

20000070729 NASA Goddard Space Flight Center, Greenbelt, MD USA

Streamlining Collaborative Planning in Spacecraft Mission Architectures

Misra, Dhariti, AppNet, Inc., USA; Bopf, Michel, AppNet, Inc., USA; Fishman, Mark, AppNet, Inc., USA; Jones, Jeremy, NASA Goddard Space Flight Center, USA; Kerbel, Uri; Pell, Vince, AppNet, Inc., USA; [2000]; 9p; In English; SpaceOps, 19-23 Jun. 2000, Toulouse, France; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the past two decades, the planning and scheduling community has substantially increased the capability and efficiency of individual planning and scheduling systems. Relatively recently, research work to streamline collaboration between planning

systems is gaining attention. Spacecraft missions stand to benefit substantially from this work as they require the coordination of multiple planning organizations and planning systems. Up to the present time this coordination has demanded a great deal of human intervention and/or extensive custom software development efforts. This problem will become acute with increased requirements for cross-mission plan coordination and multi -spacecraft mission planning. The Advanced Architectures and Automation Branch of NASA's Goddard Space Flight Center is taking innovative steps to define collaborative planning architectures, and to identify coordinated planning tools for Cross-Mission Campaigns. Prototypes are being developed to validate these architectures and assess the usefulness of the coordination tools by the planning community. This presentation will focus on one such planning coordination too], named Visual Observation Layout Tool (VOLT), which is currently being developed to streamline the coordination between astronomical missions

Author

Scheduling; Computer Programming; Mission Planning; Organizations; Streamlining

20000072500 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Defense Acquisitions: Improvements Needed in Military Space Systems' Planning and Education
May 2000; 49p; In English
Report No.(s): AD-A377408; GAO/NSIAD-00-81; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The increasing use of military and commercial satellite systems for national security and business purposes will have significant implications for the USA in the 21st century. The Department of Defense (DOD) has traditionally used satellite systems in passive roles to support military operations - for example, to collect intelligence data, warn of ballistic missile launches, transmit voice and data communications, obtain meteorological data, and provide navigation signals. Now, plans are being developed to expand the use of military satellite systems and develop technologies such as lasers and electronic jammers that could be used to actively conduct combat operations from space. With advances in information technology, the commercial use of satellites is also expanding, particularly in telecommunications. In addition, single satellite systems, for example, navigation, environmental, and imagery systems - that originally served government missions, are increasingly providing capabilities to both government and commercial users. The non- government applications are now generating large amounts of commercial revenue. National space policy treats U.S. satellite systems as national property that organizations have the right to operate without deliberate interference. to the extent that such interference were to occur, the U.S. Space Command visualizes that military forces may be called upon to provide protection, just as navies protected sea commerce and armies protected the nation's expansion westward during earlier centuries.

DTIC

Information Systems; Technology Utilization; Artificial Satellites; Congressional Reports; Military Operations; Aerospace Systems

20000072885 NASA Marshall Space Flight Center, Huntsville, AL USA
Laser Ablative Force Measurements on Manmade Space Debris
Gray, P. A., NASA Marshall Space Flight Center, USA; Edwards, D. L., NASA Marshall Space Flight Center, USA; Carruth, M. R., NASA Marshall Space Flight Center, USA; Campbell, J. W., NASA Marshall Space Flight Center, USA; [2001]; 3p; In English; 39th; Aerospace Sciences, 8-11 Jan. 2001, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A threat to spacecraft in long-term low earth orbits is the high probability of impacts with small particles of man-made debris in the 1cm to 10cm size range. Adequate shielding can be designed to mitigate the effects of impact from particles less than I cm. Debris particles greater than 10cm are less numerous and can be avoided by course changes. Debris particles in the range of 1 to 10cm are difficult to detect and shield spacecraft from damage. One possible solution for 1cm-10cm size debris is to de-orbit the particles with a ground or space based laser. This is accomplished through the process of ablation. A small particle hit with a laser pulse of sufficient intensity will experience a small force opposite to the direction of the laser resulting in a small portion of the material being ionized (ablated). This force is sufficient to change the orbit of the particles and cause them to de-orbit. The laser intensity level necessary for ablation to occur will be measured on different coatings and materials that are commonly used on spacecraft. This investigation will examine several common space flight materials such as white and black coatings and bare aluminum for ablative coupling to a pulsed ruby laser. These materials will be evaluated to determine the optimum coupling coefficient between the laser and the material. The coupling coefficient is defined as the ratio of the momentum transferred to the energy of the laser. The optimum coupling coefficient occurs when the coupling coefficient is a maximum, i.e. the largest amount of momentum change for the least amount of laser intensity. This optimum coupling coefficient is a function of the wavelength of the laser and the absorptivity of the material at that wavelength. The more absorptive a material the greater the coupling between

the laser and the material. The material type is also an important factor since some materials have a much lower ablative threshold than others.

Author

Laser Materials; Space Debris; Laser Ablation; Force Distribution; Pulsed Lasers

20000074087 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Deep Space 1 and Space Technology 4/Champollion Missions

Weissman, Paul R., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

NASA's New Millennium Program (NMP) is designed to develop, test, and flight validate new, advanced technologies for planetary and Earth exploration missions, using a series of low cost spacecraft. Two of NMP's current missions include encounters with comets and asteroids. The Deep Space 1 mission was launched on October 24, 1998 and will fly by asteroid 1992 KD on July 29, 1999, and possibly Comet Wilson-Harrington and/or Comet Borrelly in 2001. The Space Technology 4/Champollion mission will be launched in April, 2003 and will rendezvous with, orbit and land on periodic Comet Tempel 1 in 2006. ST-4/Champollion is a joint project with CNES, the French space agency. The DS-1 mission is going well since launch and has already validated several major technologies, including solar electric propulsion (SEP), solar concentrator arrays, a small deep space transponder, and autonomous navigation. The spacecraft carries two scientific instruments: MICAS, a combined visible camera and UV and IR spectrometers, and PEPE, an ion and electron spectrometer. Testing of the science instruments is ongoing. Following the asteroid encounter in July, 1999, DS-1 will go on to encounters with one or both comets if NASA approves funding for an extended mission. The ST-4/Champollion mission will use an advanced, multi-engine SEP system to effect a rendezvous with Comet P/Tempel 1 in February, 2006, after a flight time of 2.8 years. After orbiting the comet for several months in order to map its surface and determine its gravity field, ST-4/Champollion will descend to the comet's surface and will anchor itself with a 3-meter long harpoon. Scientific experiments include narrow and wide angle cameras for orbital mapping, panoramic and near-field cameras for landing site mapping, a gas chromatograph/mass spectrometer, a combined microscope and infrared spectrometer, and physical properties probes. Cometary samples will be obtained from depths up to 1.4 meters. The spacecraft is solar powered with rechargeable batteries, thus allowing a long duration mission on the nucleus surface. At the time of this writing, the ST-4/Champollion spacecraft was undergoing a major redesign to fit within NASA cost constraints, and approval of the mission is pending.

Author

Autonomous Navigation; Cameras; Technology Assessment; Performance Tests; Deep Space; Mass Spectrometers; Panoramic Cameras; Solar Electric Propulsion; Ultraviolet Spectrometers

20000074096 NASA Marshall Space Flight Center, Huntsville, AL USA

Black Holes, Worm Holes, and Future Space Propulsion

Barret, Chris, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; SWE Conference, 27 Jun. - 1 Jul. 2000, Washington, DC, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA has begun examining the technologies needed for an Interstellar Mission. In 1998, a NASA Interstellar Mission Workshop was held at the California Institute of Technology to examine the technologies required. Since then, a spectrum of research efforts to support such a mission has been underway, including many advanced and futuristic space propulsion concepts which are being explored. The study of black holes and wormholes may provide some of the breakthrough physics needed to travel to the stars. The first black hole, CYGXI, was discovered in 1972 in the constellation Cygnus X-1. In 1993, a black hole was found in the center of our Milky Way Galaxy. In 1994, the black hole GRO J1655-40 was discovered by the NASA Marshall Space Flight center using the Gamma Ray Observatory. Today, we believe we have found evidence to support the existence of 19 black holes, but our universe may contain several thousands. This paper discusses the dead star states - - both stable and unstable, white dwarfs, neutron stars, pulsars, quasars, the basic features and types of black holes: nonspinning, nonspinning with charge, spinning, and Hawking's mini black holes. The search for black holes, gravitational waves, and Laser Interferometer Gravitational Wave Observatory (LIGO) are reviewed. Finally, concepts of black hole powered space vehicles and wormhole concepts for rapid interstellar travel are discussed in relation to the NASA Interstellar Mission.

Author

Black Holes (Astronomy); Interstellar Travel; Spacecraft Propulsion; Celestial Bodies; Gravitational Waves

13
ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

20000068448 Kaman Sciences Corp., Engineering Sciences Div., Alexandria, VA USA

On-Orbit Collision Hazard Analysis in Low Earth Orbit Using the Poisson Probability Distribution, 1.0

Aug. 26, 1992; 10p; In English

Report No.(s): PB2000-105834; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Any object placed in orbit around the Earth has a risk of colliding with other orbiting objects. For mission planning and safety reasons, it is useful to understand and assess the level of collision risk by determining the probability that a given object will collide with currently orbiting objects. Several techniques can be used to calculate the collision hazard for orbiting spacecraft. This primer introduces one method for analyzing collision risks that utilizes the Poisson distribution and principles of the kinetic theory of gases. Also, this primer addresses its application to low Earth orbit (LEO) only.

NTIS

Poisson Density Functions; Probability Theory; Low Earth Orbits; Spacecraft Orbits; Collision Avoidance

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also 18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.

20000068443 NASA Marshall Space Flight Center, Huntsville, AL USA

Magnetic Launch Assist

Jacobs, W. A., NASA Marshall Space Flight Center, USA; [2000]; 18p; In English; 10th; 10th EML Symposium, 25-28 Apr. 2000, San Francisco, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the ever-increasing cost of getting to space and the need for safe, reliable, and inexpensive ways to access space, NASA is taking a look at technologies that will get us there. One of these technologies is Magnetic Launch Assist (MagLev). This is the concept of using both magnetic levitation and magnetic propulsion to provide an initial velocity by using electrical power from ground sources. The use of ground based power can significantly reduce operational costs over the consumables necessary to attain the same velocity. The technologies to accomplish this are both old and new. The concept of MagLev has been around for a long time and several MagLev Trains have already been made. Where NASA's MagLev diverges from the traditional train is in the immense power required to propel this vehicle to 600 feet per second in less than 10 seconds. New technologies or the upgrade of existing technologies will need to be investigated in areas of energy storage and power switching. Plus the separation of a very large mass (the space vehicle) and the aerodynamics of that vehicle while on the carrier are also of great concern and require considerable study and testing. NASA's plan is to mature these technologies in the next 10 years to achieve our goal of launching a full sized space vehicle off a MagLev rail.

Author

Launching; Magnetic Suspension; Switching; Low Cost

20000068527 NASA Kennedy Space Center, Cocoa Beach, FL USA

INTELSAT V-A (F-10) Launch

Mar. 22, 1985; In English; Videotape: 38 min. 50 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000078610; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Footage shows panoramic views of the Atlas launch vehicle on the launch complex. Also shown are ignition, liftoff, several different launch replays from different cameras, and views of the complex after launch.

CASI

Intelsat Satellites; Atlas Launch Vehicles

20000068530 NASA, Washington, DC USA

Hypersonics Before the Shuttle: A Concise History of the X-15 Research Airplane

Jenkins, Dennis R., NASA, USA; June 2000; 132p; In English

Report No.(s): NASA/SP-2000-4518; NAS 1.21:4518; LC-00-038683; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

It is a beginning. Over forty-five years have elapsed since the X-15 was conceived; 40 since it first flew. and 31 since the program ended. Although it is usually heralded as the most productive flight research program ever undertaken, no serious history has been assembled to capture its design, development, operations, and lessons. This monograph is the first step towards that history. Not that a great deal not previously been written about the X-15, because it has. But most of it has been limited to specific aspects of the program; pilot's stories, experiments. lessons-learned, etc. But with the exception of Robert S. Houston's history published by the Wright Air Development Center in 1958, and later included in the Air Force History Office's Hypersonic Revolution, no one has attempted to tell the entire story. and the WADC history is taken entirely from the Air Force perspective, with small mention of the other contributors.

Derived from text
Hypersonics; Research Aircraft; Histories; X-15 Aircraft; Aircraft Design

20000069854 Aerospace Corp., Lab. Operations, El Segundo, CA USA

Ground Cloud Dispersion Measurements During the Titan IV Mission Number K16 (24 April 1996) at Cape Canaveral Air Force Station. Volume 2 - Further Analysis of Quantitative Imagery and of Aircraft HCl Data

Abernathy, R. N.; Foster, K. L.; Apr. 03, 2000; 51p; In English

Contract(s)/Grant(s): F04701-93-C-0094

Report No.(s): AD-A377804; TR-2000(1490)-1-VOL-2; SMC-TR-00-08; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A previous report presented an overview and data summary for ground cloud dispersion measurements during the Titan IV mission #K16 launch from CCAFS on 24 April 1996. That report documented the instrumentation, methods of analysis, and preliminary results for the program. The preliminary results included the following: (1) the imagery-derived cloud speed, direction, and position for the first 6 min after launch; (2) summary plots of the aircraft-derived HCl data for the first 88 min after launch; and (3) comparison of imagery-derived, aircraft-derived, rawinsonde-derived data to REEDM version 7.07 predictions. This second report provides a detailed comparison of the imagery-derived extent of the ground cloud to simultaneous aircraft sampling data. The combined data provides a three-dimensional perspective of the exhaust cloud during the first 6 min after launch. In addition, this report includes a more detailed graphing and analysis of the aircraft's HCl measurements. The #K16 imagery and aircraft data documented substantial differences between measured and T-0.7 h REEDM version 7.07 predictions. According to the quantitative visible imagery from UCS-7 and Press sites, the cloud took 3.5 min to stabilize (20% faster than predicted), stabilized at 1023 m in altitude (35% higher than predicted), moved in a south-southwesterly direction (versus the east-southeasterly prediction), and moved at an average speed of 3.6 m/s (38% slower than predicted). Comparison of the aircraft's HCl measurements to the visible extent of the cloud revealed consistent edge detection by both methods. The aircraft's HCl measurements also confirmed the imagery-derived bearing for the lower lobe of the ground cloud and were consistent with the observed high-altitude wind shear to the east.

DTIC
Solid Propellant Rocket Engines; Launch Vehicles; Clouds; Wind Shear

20000070419 NASA Marshall Space Flight Center, Huntsville, AL USA

Advanced Guidance and Control Project for Reusable Launch Vehicles

Hanson, John M., NASA Marshall Space Flight Center, USA; [2000]; 14p; In English; Guidance, Navigation, and Control, Aug. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 715-33-SA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goals of this project are to significantly reduce the time and cost associated with guidance and control design for reusable launch vehicles, and to increase their safety and reliability. Success will lead to reduced cycle times during vehicle design and to reduced costs associated with flying to new orbits, with new payloads, and with modified vehicles. Success will also lead to more robustness to unforeseen circumstances in flight thereby enhancing safety and reducing risk. There are many guidance and control methods available that hold some promise for improvement in the desired areas. Investigators are developing a representative set of independent guidance and control methods for this project. These methods are being incorporated into a high-fidelity off is being conducted across a broad range of flight requirements. The guidance and control methods that perform the best will have demonstrated the desired qualities.

Author
Spacecraft Guidance; Control Systems Design; Spacecraft Control; X-33 Reusable Launch Vehicle

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information, see also 03 Air Transportation and Safety and 15 Launch Vehicles and Launch Vehicles, and 18 Spacecraft Design, Testing and Performance. For space suits, see 54 Man/System Technology and Life Support.

20000070416 NASA Marshall Space Flight Center, Huntsville, AL USA
X-33, Stepping Stone ot Low Cost Access to Space
Naftel, J. Chris, NASA Marshall Space Flight Center, USA; Aug. 12, 2000; 30p; In English; International Space University 2000 Summer Session, 2000, Valparaiso, Chile
Contract(s)/Grant(s): NCC8-115; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In response to the Access to Space Study, which was conducted in 1993 through the Office of Space Systems Development, an advanced technology Reusable Launch Vehicle (RLV) was selected for demonstration. The X-33 was advanced as an demonstration project, to build and test a 53-percent scale prototype of an operational RLV, it would also demonstrate new technologies which would be required to assure the operation of the new RLV. This presentation reviews the progress of the X-33 development and supporting sites. The X-33 design has been completed and fabrication and assembly is progressing well. The X-33 launch site has been completed. The first LH2 tank and engine is in testing. This will lead to the full scale development of VentureStar(tm). CASI
X-33 Reusable Launch Vehicle; Reusable Spacecraft; Venturestar Launch Vehicle

20000070745 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
Modeling the Space Shuttle Liquid Hydrogen Subsystem *Final Report*
Atanacio, Bemina; Apr. 2000; 40p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A377656; CMU/SEI-2000-TN-002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes experiences with modeling the liquid hydrogen subsystem of the space shuttle. The Symbolic Model Verifier tool and the Software Cost Reduction tool set were used to model and specify the behavior of the system. The tools were then used to check for errors in the models. Modeling a problem from several different perspectives offers the chance to uncover discrepancies among different models and to understand the problem space enough to ask important questions about the behavior of the system. Each tool presented different issues in modeling the problem. Both models and a breakdown of the time spent during this study are included as appendices.
DTIC
Spacecraft Models; Dynamic Models; Mathematical Models; Space Shuttles; Liquid Hydrogen; Propulsion System Configurations; Spacecraft Configurations

20000072421 NASA Marshall Space Flight Center, Huntsville, AL USA
NASA Space Transportation: Safety, Cost and Performance Initiatives
Rogacki, John Row, NASA Marshall Space Flight Center, USA; [2000]; 21p; In English; Space Transportation Business, 11-13 May 2000, Paris, France; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents viewgraphs on NASA's Space Transportation. A space launch initiative is developed to provide a safe, reliable and affordable access to space. The topics include: 1) NASA's Integrated Architectural Approach; and 2) Safe, Reliable, and Affordable... Building a Highway to Space.
CASI
Costs; Space Transportation; Aerospace Safety; Spacecraft Launching; Spacecraft Performance

SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information, see also 04 Aircraft Communications and Navigation and 32 Communications and Radar.

20000073722 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Mathematics of Navigating the Solar System
Hintz, Gerald, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

In navigating spacecraft throughout the solar system, the space navigator relies on three academic disciplines - optimization, estimation, and control - that work on mathematical models of the real world. Thus, the navigator determines the flight path that will consume propellant and other resources in an efficient manner, determines where the craft is and predicts where it will go, and transfers it onto the optimal trajectory that meets operational and mission constraints. Mission requirements, for example, demand that observational measurements be made with sufficient precision that relativity must be modeled in collecting and fitting (the estimation process) the data, and propagating the trajectory. Thousands of parameters are now determined in near real-time to model the gravitational forces acting on a spacecraft in the vicinity of an irregularly shaped body. Completing these tasks requires mathematical models, analyses, and processing techniques. Newton, Gauss, Lambert, Legendre, and others are justly famous for their contributions to the mathematics of these tasks. More recently, graduate students participated in research to update the gravity model of the Saturnian system, including higher order gravity harmonics, tidal effects, and the influence of the rings. This investigation was conducted for the Cassini project to incorporate new trajectory modeling features in the navigation software. The resulting trajectory model will be used in navigating the 4-year tour of the Saturnian satellites. Also, undergraduate students are determining the ephemerides (locations versus time) of asteroids that will be used as reference objects in navigating the New Millennium's Deep Space 1 spacecraft autonomously.
Author
Mathematical Models; Solar System; Navigation; Computer Programs; Software Engineering; Navigators; Flight Paths; Trajectories

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SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems, see 54 Man/System Technology and Life Support. For related information, see also 05 Aircraft Design, Testing and Performance, 39 Structural Mechanics, and 16 Space Transportation and Safety.

20000068485 NASA Marshall Space Flight Center, Huntsville, AL USA
International Space Station Environmental Control and Life Support System Status: 1999-2000
Reuter, James L., NASA Marshall Space Flight Center, USA; [2000]; 14p; In English; Environmental Systems, 10-13 Jul. 2000, Toulouse, France; Sponsored by Society of Automotive Engineers, Inc., USA
Report No.(s): Rept-00ICES-216; Copyright; Avail: Issuing Activity

The International Space Station (ISS) Environmental Control and Life Support (ECLS) system includes regenerative and non-regenerative technologies which provide the basic life support functions to support the crew, while maintaining a safe and habitable shirtsleeve environment. This paper provides a summary of the U.S. ECLS system activities over the past year, covering the period of time between May 1999 and April 2000. Assembly of the ISS has been delayed due ot changes in element processing schedules. The 2A.1 logistics flight to ISS occurred in May 1999. The remaining Phase 2 elements have completed most of the element level testing and integration and are approaching final reviews for acceptance for flight. The Phase 3 regenerative ECLS designs have reached the Critical Design Review phase, while several of the Phase 3 elements have held Preliminary of Critical Design Reviews.
Author
Environmental Control; International Space Station; Life Support Systems; Space Missions

20000068517 NASA Kennedy Space Center, Cocoa Beach, FL USA
Atlas-Uncrating of SOHO satellite at the SAEF 2
Aug. 05, 1995; In English; Videotape: 6 min. 58 sec. playing time, in color, without sound

Footage shows the removal of the SOHO satellite from its packaging at the Spacecraft Assembly and Encapsulation Facility (SAEF) 2.
CASI
SOHO Mission; Scientific Satellites

20000068925 NASA Marshall Space Flight Center, Huntsville, AL USA
Loads Combination Research at Marshall Space Flight Center
Ferebee, R., NASA Marshall Space Flight Center, USA; June 2000; 40p; In English

This is the result of a study conducted by the Structural Dynamics Division of the Marshall Space Flight Center concerning the combination of low- and high-frequency dynamic loads for spacecraft design. Low-frequency transient loads are combined with high frequency acoustically induced loads to arrive at a limit load, for design purposes. Different methods are used for combining the loads which can lead to considerable variation in limit loads, depending on which NASA Center did the calculation. This study investigates several different combination methods and compares the combination methods with Spacelab 1 flight data. In addition, the relative timing of low- and high-frequency loads is examined.
Author
Transient Loads; Random Loads; Dynamic Structural Analysis; High Frequencies; Low Frequencies

20000068936 NASA Kennedy Space Center, Cocoa Beach, FL USA
TOPEX Press Conference (2 of 2)
Feb. 26, 1993; In English; Videotape: 21 min. 23 sec. playing time, in color, with sound

Footage shows the continuation of the TOPEX Press Conference. The panelists are seen answering questions from the participating audience as well as from NASA Centers. Answers address Kelvin waves, pulses of warm water, sea surface temperature, and the direction in which the project is heading. Also presented are TOPEX/POSEIDON playbacks of the topography and currents of the World Ocean. The video also shows stills of the Central Pacific Ocean from Nov. 1992 to Jan. 1993 and observations of the El Nino events.
CASI
Conferences; TOPEX; Poseidon Satellite; Oceanography; Ocean Currents; Topography; Kelvin Waves

20000070465 NASA Goddard Space Flight Center, Greenbelt, MD USA
Preventing Damaging Pressure Gradients at the Walls of an Inflatable Space System
Scialdone, John J., NASA Goddard Space Flight Center, USA; April 2000; 6p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An inflatable structural system to deploy a space system such as a solar shield, an antenna or another similar instrument, requires a stiffening element after it is extended by the inflated gas pressure. The stiffening element has to be packaged in a folded configuration before the deployment. It must be relatively small, lightweight, non-damaging to the inflated system, and be able to become stiff in a short time. One stiffening method is to use a flexible material inserted in the deployable system, which, upon a temperature curing, can become stiff and is capable to support the entire structure. There are two conditions during the space operations when the inflated volume could be damaged: during the transonic region of the launch phase and when the curing of the rigidizing element occurs. In both cases, an excess of pressure within the volume containing the rigid element could burst the walls of the low-pressure gas inflated portion of the system. This paper investigates those two conditions and indicates the vents, which will prevent those damaging overpressures. Vent openings at the non-inflated volumes have been calculated for the conditions existing during the launch. Those vents allow the initially folded volume to exhaust the trapped atmospheric gas at approximately the same rate as the ambient pressure drops. That will prevent pressure gradients across the container walls which otherwise could be as high as 14.7 psi. The other condition occurring during the curing of the stiffening element has been investigated. This has required the testing of the element to obtain the gas generation during the curing and the transformation from a pliable material to a rigid one. The tested material is a composite graphite/epoxy weave. The outgassing of the uncured sample at 121C was carried with the Cahn Microbalance and with other outgassing facilities including the micro-CVCM ASTM E-595 facility. The tests provided the mass of gas evolved during the test. That data, including the chemical nature of the evolved gas, provided the data for the calculation of the pressure produced within the volume. The evaluation of the areas of the vents that would prevent exces-

sive pressures and provide a rapid release of the gas away from contamination sensitive surfaces has been carried out. The pressure decay with time has been indicated.

Author

Overpressure; Pressure Gradients; Stiffening; Venting; Inflatable Space Structures; Curing; Outgassing

20000070492 NASA Kennedy Space Center, Cocoa Beach, FL USA

AC-67 Press Conference

Mar. 26, 1987; In English; Videotape: 29 min., 05 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2000078609; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

On March 26, 1987, after the launch of an Atlas/Centaur rocket with a payload of a Navy Communications Satellite, a problem developed and the rocket was lost. This videotape is a press conference held to review the incident. Mr. John Gibb, the Atlas-Centaur Program Manager at Lewis Research Center, opens the press conference with a statement that reviews the situation, and what is known about the accident. He reviews the constraints to launch and explains that to the best of his knowledge there was no violation of these constraints. He further states that a review panel will investigate the circumstances and make recommendations. The press conference is then opened up to questions. Most of the questions concern the weather conditions and the existence of lightning in the area. The Air Force representative, Colonel John Albrook, is asked if the loss of the satellite would pose any problems. He answers that there were several satellites performing the role for which this satellite was slated, and that these were still healthy, and capable of continuing for a considerable length of time.

CASI

Lightning; Weather; Flight Hazards; Meteorological Parameters; Liftoff (Launching)

20000070728 NASA Marshall Space Flight Center, Huntsville, AL USA

Mars Global Reference Atmospheric Model 2000 Version (Mars-GRAM 2000): Users Guide

Justus, C. G., Computer Sciences Corp., USA; James, B. F., NASA Marshall Space Flight Center, USA; May 2000; 54p; In English

Contract(s)/Grant(s): NAS8-60000

Report No.(s): NASA/TM-2000-210279; NAS 1.15:210279; M-980; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents Mars Global Reference Atmospheric Model 2000 Version (Mars-GRAM 2000) and its new features. All parameterizations for temperature, pressure, density, and winds versus height, latitude, longitude, time of day, and L(sub s) have been replaced by input data tables from NASA Ames Mars General Circulation Model (MGCM) for the surface through 80-km altitude and the University of Arizona Mars Thermospheric General Circulation Model (MTGCM) for 80 to 170 km. A modified Stewart thermospheric model is still used for higher altitudes and for dependence on solar activity. "Climate factors" to tune for agreement with GCM data are no longer needed. Adjustment of exospheric temperature is still an option. Consistent with observations from Mars Global Surveyor, a new longitude-dependent wave model is included with user input to specify waves having 1 to 3 wavelengths around the planet. A simplified perturbation model has been substituted for the earlier one. An input switch allows users to select either East or West longitude positive. This memorandum includes instructions on obtaining Mars-GRAM source code and data files and for running the program. It also provides sample input and output and an example for incorporating Mars-GRAM as an atmospheric subroutine in a trajectory code.

Author

Atmospheric General Circulation Models; Mars Atmosphere; Mathematical Models; Temperature; Pressure; Density (Mass/ Volume); Wind (Meteorology); Parameterization; Longitude

20000070864 NASA Marshall Space Flight Center, Huntsville, AL USA

A Hybrid Cadre Concept for International Space Station (ISS) Operations

Hagopian, Jeff, NASA Marshall Space Flight Center, USA; Mears, Teri, Teledyne Brown Engineering, USA; [2000]; 1p; In English; Space Operations, 19-23 Jun. 2000, Toulouse, France; No Copyright; Avail: Issuing Activity; Abstract Only

The International Space Station (ISS) is a continuously operating on-orbit facility, with a ten to fifteen year lifetime. The staffing and rotation concepts defined and implemented for the ISS program must take into account the unique aspects associated with long duration mission operations. Innovative approaches to mission design and operations support must be developed and explored which address these unique aspects. Previous National Aeronautics and Space Administration (NASA) man-based space programs, with the exception of Skylab, dealt primarily with short duration missions with some amount of down time between missions; e.g., Shuttle, Spacelab, and Spacehab programs. The ISS Program on the other hand requires continuous support, with no down time between missions. ISS operations start with the first element launch and continue through the end of the program. It is this key difference between short and long duration missions that needs to be addressed by the participants in the ISS Program

in effectively and efficiently staffing the positions responsible for mission design and operations. The primary drivers considered in the development of staffing and rotation concepts for the ISS Program are budget and responsiveness to change. However, the long duration aspects of the program necessitate that personal and social aspects also be considered when defining staffing concepts. to satisfy these needs, a Hybrid Cadre concept has been developed and implemented in the area of mission design and operations. The basic premise of the Hybrid Cadre concept is the definition of Increment-Independent and Increment-Dependent cadre personnel. This paper provides: definitions of the positions required to implement the concept, the rotation scheme that is applied to the individual positions, and a summary of the benefits and challenges associated with implementing the Hybrid Cadre concept.

Author

International Space Station; Mission Planning; Spacecraft Modules; Operational Problems

20000072437 NASA Goddard Space Flight Center, Greenbelt, MD USA

CPL Applications on the EOS-TERRA Spacecraft

Ku, Jentung, NASA Goddard Space Flight Center, USA; Butler, Dan, NASA Goddard Space Flight Center, USA; Ottenstein, Laura, NASA Goddard Space Flight Center, USA; Swanson, Ted, NASA Goddard Space Flight Center, USA; Fitzkee, Archie, NASA Goddard Space Flight Center, USA; [2000]; 29p; In English; Two-Phase Thermal Control Technology, 6-7 Jul. 2000, Noordwijk, Netherlands; Sponsored by European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation reviews the use of Capillary Pumped Loops on the EOS-TERRA spacecraft, It starts with a brief review of the status of CPL technology. On the TERRA spacecraft, CPL's will be used for thermal control of 3 instruments. The document reviews the ground testing, and states that life testing will continue to run for three year, even after the launch.The document has schematic diagrams of the EOS-AM spacecraft, the Advanced Spaceborne Thermal Emission and Reflection Radiometer - Thermal-Infrared Radiometer (ASTER-TIR) CPL configuration, the Advanced Spaceborne Thermal Emission and Reflection Radiometer - Short-Wave-Infrared Radiometer (ASTER-SWIR). The use of Measurements of Pollution In The Troposphere (MOPITTS) Capillary Pumped Heat Transport System (CPHTS) is reviewed, and the performance is summarized in several charts. The use of CPHTS in the ASTER-SWIR is reviewed. The loops in the ASTER-TIR module is also reviewed, and the problems with the second loop temperature control is discussed.

CASI

Heat Transfer; Infrared Radiometers; Temperature Control; Thermocapillary Migration; Capillary Tubes; Tube Heat Exchangers

20000072488 NASA Marshall Space Flight Center, Huntsville, AL USA

Putting ROSE to Work: A Proposed Application of a Request-Oriented Scheduling Engine for Space Station Operations

Jaap, John, NASA Marshall Space Flight Center, USA; Muery, Kim, NASA Marshall Space Flight Center, USA; [2000]; 10p; In English; Spacecraft Operations, 19-23 Jun. 2000, Toulouse, France; Sponsored by Spacecraft Operations Oriented International Association, Unknown; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Scheduling engines are found at the core of software systems that plan and schedule activities and resources. A Request-Oriented Scheduling Engine (ROSE) is one that processes a single request (adding a task to a timeline) and then waits for another request. For the International Space Station, a robust ROSE-based system would support multiple, simultaneous users, each formulating requests (defining scheduling requirements), submitting these requests via the internet to a single scheduling engine operating on a single timeline, and immediately viewing the resulting timeline. ROSE is significantly different from the engine currently used to schedule Space Station operations. The current engine supports essentially one person at a time, with a pre-defined set of requirements from many payloads, working in either a "batch" scheduling mode or an interactive/manual scheduling mode. A planning and scheduling process that takes advantage of the features of ROSE could produce greater customer satisfaction at reduced cost and reduced flow time. This paper describes a possible ROSE-based scheduling process and identifies the additional software component required to support it. Resulting changes to the management and control of the process are also discussed.

Author

International Space Station; Scheduling; Software Engineering; Hardware; Architecture (Computers)

20000073308 Department of Defense, Office of the Inspector General, Arlington, VA USA

Ultra High Frequency Follow-On Satellite

Jun. 30, 1992; 67p; In English

Report No.(s): AD-A377542; IG/DOD-92-112; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Navy's ultra-High Frequency Follow-on Satellite (the Satellite) will provide key command and control links for mobile forces of DoD and other Government agencies. Satellite production began in July 1988 with an estimated cost of $1.7 billion (then-year dollars) for nine satellites.
DTIC
Ultrahigh Frequencies; Artificial Satellites; Command and Control

20000074083 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
A Light-Weight Inflatable Hypersonic Drag Device for Planetary Entry
McRonald, Angus D., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The author has analyzed the use of a light-weight inflatable hypersonic drag device, called a ballute, for flight in planetary atmospheres, for entry, aerocapture, and aerobraking. Studies to date include Mars, Venus, Earth, Saturn, Titan, Neptune and Pluto, and data on a Pluto lander and a Mars orbiter will be presented to illustrate the concept. The main advantage of using a ballute is that aero, deceleration and heating in atmospheric entry occurs at much smaller atmospheric density with a ballute than without it. For example, if a ballute has a diameter 10 times as large as the spacecraft, for unchanged total mass, entry speed and entry angle, the atmospheric density at peak convective heating is reduced by a factor of 100, reducing the heating by a factor of 10 for the spacecraft and a factor of 30 for the ballute. Consequently the entry payload (lander, orbiter, etc) is subject to much less heating, requires a much reduced thermal. protection system (possibly only an MLI blanket), and the spacecraft design is therefore relatively unchanged from its vacuum counterpart. The heat flux on the ballute is small enough to be radiated at temperatures below 800 K or so. Also, the heating may be reduced further because the ballute enters at a more shallow angle, even allowing for the increased delivery angle error. Added advantages are less mass ratio of entry system to total entry mass, and freedom from the low-density and transonic instability problems that conventional rigid entry bodies suffer, since the vehicle attitude is determined by the ballute, usually released at continuum conditions (hypersonic for an orbiter, and subsonic for a lander). Also, for a lander the range from entry to touchdown is less, offering a smaller footprint. The ballute derives an entry corridor for aerocapture by entering on a path that would lead to landing, and releasing the ballute adaptively, responding to measured deceleration, at a speed computed to achieve the desired orbiter exit conditions. For a lander an accurate landing point could be achieved by providing the lander with a small gliding capacity, using the large potential energy available from being subsonic at high altitude. Alternatively the ballute can be retained to act as a parachute or soft-landing device, or to float the payload as a buoyant aerobot. As expected, the ballute has smaller size for relatively small entry speeds, such as for Mars and Titan, or for the extensive atmosphere of a low-gravity planet such as Pluto. Details of a ballute to place a small Mars orbiter and a small Pluto lander will be given to illustrate the concept. The author will discuss presently available ballute materials and a development program of aerodynamic tests and materials that would be required for ballutes to achieve their full potential.
Author
Aerodynamic Heating; Research; Ballutes; Buoyancy; Drag Devices; Floats; Inflatable Structures; Microgravity; Planetary Atmospheres; Spacecraft Design

20000074093 Auburn Univ., Space Power Inst., AL USA
POWOW: A Modular, High Power Spacecraft Concept
Brandhorst, Henry W., Jr., Auburn Univ., USA; [2000]; 1p; In English; 35th; 35th Intersociety Energy Conversion Engineering Conference, 23-27 Jul. 2000, Las Vegas, NV, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A robust space infrastructure encompasses a broad range of mission needs along with an imperative to reduce costs of satellites meeting those needs. A critical commodity for science, commercial and civil satellites is power at an affordable cost. The POWOW (POwer WithOut Wires) spacecraft concept was created to provide, at one end of the scale, multi-megawatts of power yet also be composed of modules that can meet spacecraft needs in the kilowatt range. With support from the NASA-sponsored Space Solar Power Exploratory Research and Technology Program, the POWOW spacecraft concept was designed to meet Mars mission needs - while at the same time having elements applicable to a range of other missions. At Mars, the vehicle would reside in an aerosynchronous orbit and beam power to a variety of locations on the surface. It is the purpose of this paper to present the latest concept design results. The Space Power Institute along with four companies: Able Engineering, Inc., Entech, Inc., Primex Aerospace Co., and TECSTAR have produced a modular, power-rich electrically propelled spacecraft design that meets these requirements. In addition, it also meets a range of civil and commercial needs. The spacecraft design is based on multijunction Ill-V solar cells, the new Stretched Lens Aurora (SLA) module, a lightweight array design based on a multiplicity of 8 kW end-of-life subarrays and electric thrusters. The solar cells have excellent radiation resistance and efficiencies above 30%. The SLA has a concentration ratio up to 15x while maintaining an operating temperature of 80 C. The design of the 8 kW array building block will be presented and its applicability to commercial and government missions will be discussed. Electric propulsion options

include Hall, MPD and ion thrusters of various power levels and trade studies have been conducted to define the most advantageous options. The present baseline spacecraft design providing 900 kW using technologies expected to be available in 2003 will be described. Areal power densities of nearly 400 W/meters squared at 80 C operating temperatures and wing level specific powers of over 400 W/kg are projected. Details of trip times and payloads to Mars will be presented as well as trade studies of various electric propulsion options. Trip times compare favorably with chemical propulsion options. Because the design is modular, learning curve methodology can be applied to determine expected cost reductions. These results will also be included. This paper has not been presented at a previous meeting.

Author

Solar Power Satellites; Spacecraft Design; Spacecraft Modules; Solar Electric Propulsion

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SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information, see also 06 Aircraft Instrumentation and Avionics; For spaceborne instruments not integral to the vehicle itself see 35 Instrumentation and Photography; For spaceborne telescopes and other astronomical instruments see 89 Astronomy, Instrumentation and Photography; For spaceborne telescopes and other astronomical instruments see 89 Astronomy.

20000070801 NASA Marshall Space Flight Center, Huntsville, AL USA

The Plasmasphere as Seen by the IMAGE EUV Instrument

Gallagher, D. L., NASA Marshall Space Flight Center, USA; Sandel, B., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Geospace Environment Modeling, 19-23 Jun. 2000, Aspen, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The IMAGE spacecraft includes the extreme ultraviolet (EUV) imager, which is designed to view He+ plasmaspheric ions in the inner magnetosphere. These images provide the first opportunity to view the global distribution of plasmaspheric ions and their response to solar wind induced convection and the ring current. In addition to the generalized pattern of convection long believed to develop in thermal plasma, the EUV instrument is observing other meso-scale patterns of plasma distribution never before observed or postulated using in situ measurements. This poster presentation will present the "first light" observations of the EUV instrument and their possible interpretations.

Author

Extreme Ultraviolet Radiation; Plasmasphere; Helium Ions; Imaging Techniques; Mesoscale Phenomena

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SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information, see also 07 Aircraft Propulsion and Power; 28 Propellants and Fuels; 15 Launch Vehicles and Launch Operations; and 44 Energy Production and Conversion.

20000068435 NASA Marshall Space Flight Center, Huntsville, AL USA

Lightweight Chambers for Thrust Cell Applications

Elam, S., NASA Marshall Space Flight Center, USA; Effinger, M., NASA Marshall Space Flight Center, USA; Holmes, R., NASA Marshall Space Flight Center, USA; Lee, J., NASA Marshall Space Flight Center, USA; Jaskowiak, M., NASA Glenn Research Center, USA; [2000]; 11p; In English; 36th; 36th Joint Propulsion Conference and Exhibit, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-3131; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Traditional metals like steel and copper alloys have been used for many years to fabricate injector and chamber components of thruster assemblies. While the materials perform well, reducing engine weights would help existing and future vehicles gain performance and payload capability. It may now be possible to reduce current thruster weights up to 50% by applying composite materials. In this task, these materials are being applied to an existing thrust cell design to demonstrate new fabrication processes and potential weight savings. Two ceramic matrix composite (CMC) designs, three polymer matrix composite (PMC) designs, and two metal matrix composite (MMC) designs are being fabricated as small chamber demonstration units. In addition, a new alloy of copper, chrome, and niobium (Cu-8Cr-4Nb) is being investigated for thrust chamber liners since it offers higher strength

and increased cycle life over traditional alloys. This new alloy is being used for the liner in each MMC and PMC demonstration unit. During June-August of 2000, hot-fire testing of each unit is planned to validate designs in an oxygen/hydrogen environment at chamber pressures around 850 psi. Although the weight savings using CMC materials is expected to be high, they have proven to be much harder to incorporate into chamber designs based on current fabrication efforts. However, the PMC & MMC concepts using the Cu-8Cr-4Nb liner are nearly complete and ready for testing. Additional efforts intend to use the PMC & MMC materials to fabricate a full size thrust chamber (60K lb(sub f) thrust class). The fabrication of this full size unit is expected to be complete by October 2000, followed by hot-fire testing in November-December 2000.
Author

Thrust Chambers; Polymer Matrix Composites; Weight Reduction; Test Chambers; Life (Durability); Ceramic Matrix Composites

20000068919 NASA Marshall Space Flight Center, Huntsville, AL USA
Computer Tomography Analysis of Fastrac Composite Thrust Chamber Assemblies
Beshears, Ronald D., NASA Marshall Space Flight Center, USA; [20 April 2000]; 10p; In English; 36th, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 2000-3399; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche
     Computed tomography (CT) inspection has been integrated into the production process for NASA's Fastrac composite thrust chamber assemblies (TCAs). CT has been proven to be uniquely qualified to detect the known critical flaw for these nozzles, liner cracks that are adjacent to debonds between the liner and overwrap. CT is also being used as a process monitoring tool through analysis of low density indications in the nozzle overwraps. 3d reconstruction of CT images to produce models of flawed areas is being used to give program engineers better insight into the location and nature of nozzle flaws.
Author

Computer Aided Tomography; Inspection; Computer Graphics; Production Engineering; Composite Structures; Thrust Chambers

20000068927 Thiokol Propulsion, USA
Thiokol Solid Rocket Motors
Graves, S. R., Thiokol Propulsion, USA; [2000]; 53p; In English; Solid Rocket, 20-21 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-97238; Copyright; Avail: Issuing Activity
     This paper presents viewgraphs on thiokol solid rocket motors. The topics include: 1) Communications; 2) Military and government intelligence; 3) Positioning satellites; 4) Remote sensing; 5) Space burial; 6) Science; 7) Space manufacturing; 8) Advertising; 9) Space rescue space debris management; 10) Space tourism; 11) Space settlements; 12) Hazardous waste disposal; 13) Extraterrestrial resources; 14) Fast package delivery; and 15) Space utilities.
CASI

Solid Propellant Rocket Engines; Jet Propulsion; Reusable Rocket Engines

20000068930 Thiokol Propulsion, Brigham City, UT USA
Shuttle Rocket Motor Segment Washout
Morton, Brian, Thiokol Propulsion, USA; [2000]; 8p; In English; 8th; Global Demilitarization, 15-20 May 2000, Coeur d'Alene, ID, USA; Sponsored by Joint Operational Commanders Group, USA
Contract(s)/Grant(s): NAS3-38100; Copyright; Avail: Issuing Activity
     Thiokol Propulsion has designed, built and is operating a facility to remove propellant from large diameter rocket motors, specifically Shuttle Rocket Motor segments (12 feet diameter, 30 feet long and over 300,000 pounds). This facility was constructed using Thiokol and NASA funding to dispose of 12 filament wound segments and 4 unusable steel segments. to date, eight segments, containing approximately 2.3 million pounds of propellant have been washed out. The facility uses high-pressure water to remove the propellant from the segments. Propellant removal rates of over 3,000 pounds per hour have been demonstrated. During the washout process the majority of the Ammonium Perchlorate (AP) in the propellant is leached into the process water. This water is then processed to reclaim the AP. Over 1 million gallons of process water have been treated producing over 830,000 pounds of AP. Initially the major emphasis of the washout effort was to reclaim the AP, but early on in the program, NASA requested that Thiokol save all reusable metal hardware. Thiokol has since developed the necessary materials, controls and process requirements to ensure that the metal hardware is not damaged during washout. This included the development of a low cost corrosion inhibitor that is added to the process water. The recoverable flight hardware from the 16 segments has a replacement value

of approximately $8,230,000; so far $915,000 worth of hardware has been recovered. Even though various technical challenges had to be overcome early in the program it is currently on schedule. The current contract is scheduled to complete this year.
Author
Space Shuttle Boosters; Cleaning; Propellants; Ammonium Perchlorates; Solid Rocket Propellants

20000069803 NASA Marshall Space Flight Center, Huntsville, AL USA
An Overview of the NASA's Rocket-Based Combined Cycle (RBCC) Project
Hueter, Uwe, NASA Marshall Space Flight Center, USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 1-13; In English; See also 20000069802; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The Earth-to-Orbit goals are to reduce the payload cost to orbit by an order of magnitude, from $10,000 to $1,000 per pound, within 10 years, and by an additional order of magnitude from, thousands to hundreds of dollars per pound, within 25 years. The topics include: 1) Generations of Reusable Launch Vehicles; 2) Space Transportation Derived Requirements; 3) Options for Reducing Risk; 4) Summary-Hydrogen Fueled RBCC; 5) Aerojet Freejet Engine in Leg 4; 6) Engine A5 Description; 7) Integrated Flowpath Test Program; 8) Trailblazer; 9) Summary-Hydrocarbon Fueled RBCC; 10) Draco; and 11) Future Activities. This paper is presented in viewgraph form.
CASI
General Overviews; Reusable Launch Vehicles; Rocket-Based Combined-Cycle Engines; NASA Programs

20000069810 Boeing Co., Rocketdyne Propulsion and Power, Canoga Park, CA USA
Integrated Toolkit Development for Rocket Thrust Chamber Assembly Design and Analysis: TCAT
Farhangi, S., Boeing Co., USA; Darian, A., Boeing Co., USA; Beck, J., Boeing Co., USA; Haung, Y., Boeing Co., USA; Liang, P., Boeing Co., USA; Sindir, M., Boeing Co., USA; Jensen, R., Boeing Co., USA; Follett, W., Boeing Co., USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 91-101; In English; See also 20000069802; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Many individual computational tools are used to analyze and design components in a rocket engine thrust chamber assembly. Communication of information between these tools is usually done manually and is cumbersome. Also at present, expert knowledge of each tool is required. This can create inconsistency and sometimes inaccuracy in the results. The objective of this software development effort is to select the best tools, and to integrate and automate these tools into an easy-to-use computational package, the Thrust Chamber Analysis Toolkit, or TCAT. This paper describes the TCAT software design requirement and its architecture. The overall flow chart and code hierarchy is also presented. Code selection process and approach in addition to descriptions of individual codes and their capabilities are described. User and module interface options are evaluated and selected approach(es) are discussed. Software control system options are explored and their capabilities are evaluated. Sources of hot fire and cold flow test validation data and the validation process is briefly described. Progress to date is presented in detail and a sample case of rocket engine analysis results is discussed. Finally, the future plan options are discussed.
Author
Thrust Chambers; Design Analysis; Rocket Engines; Computational Fluid Dynamics; Software Development Tools

20000069812 Pennsylvania State Univ., Dept. of Mechanical and Nuclear Engineering, University Park, PA USA
Focused Experimental and Analytical Studies of the RBCC Rocket-Ejector Mode
Lehman, M., Pennsylvania State Univ., USA; Pal, S., Pennsylvania State Univ., USA; Schwer, D., Pennsylvania State Univ., USA; Chen, J. D., Pennsylvania State Univ., USA; Santoro, R. J., Pennsylvania State Univ., USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 121-130; In English; See also 20000069802
Contract(s)/Grant(s): NAS8-40890; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The rocket-ejector mode of a Rocket Based Combined Cycle Engine (RBCC) was studied through a joint experimental/analytical approach. A two-dimensional variable geometry rocket-ejector system with enhanced optical access was designed and fabricated for experimentation. The rocket-ejector system utilizes a single two-dimensional gaseous oxygen/gaseous hydrogen rocket as the ejector. To gain a systematic understanding of the rocket-ejector's internal fluid mechanic/combustion phenomena, experiments were conducted with both direct-connect and sea-level static configurations for a range of rocket operating conditions. Overall system performance was obtained through global measurements of wall static pressure profiles, heat flux profiles and engine thrust, whereas detailed mixing and combustion information was obtained through Raman spectroscopy measure-

ments of major species (gaseous oxygen, hydrogen, nitrogen and water vapor). These experimental efforts were complemented by Computational Fluid Dynamic (CFD) flowfield analyses.

Author

Computational Fluid Dynamics; Ejectors; Rocket-Based Combined-Cycle Engines; Combustion Physics; Design Analysis; Fabrication

20000069839 National Aerospace Lab., Tokyo Japan

Observation of the Cavitation in Rocket Turbopump Inducer, Rept-2, Backward-Traveling Rotating Cavitation

Hasegawa, S.; Watanabe, M.; Hashimoto, T.; Watanabe, Y.; Yamada, H.; Mar. 1999; 18p; In Japanese; Portions of this document are not fully legible

Report No.(s): PB2000-102564; NAL-TR-1382; No Copyright; Avail: Issuing Activity; Abstract Only

During the development of a liquid oxygen turbopump for the LE-7engine of the H-II rocket, super synchronous vibrations in the inducer were frequently observed. From research on the vibration performance of the inducer, it was concluded that shaft vibrations of this type were caused by rotating cavitation in the inducer, and it was also demonstrated that a moderately increased diameter of the pump inlet was most effective in suppressing these shaft vibrations. In the light of previous theoretical analysis, it was predicted that rotating cavitation had two unstable modes, a forward rotating cavitation and a backward rotating cavitation, which had not hitherto been observed in experiments. In the suction performance test of the inducer using the cavitation tunnel, a shaft vibration of higher frequency than the forward rotating cavitation was observed. From a study using a high-speed photograph analyzer and the spectrum analysis of the shaft vibration, it was concluded that the vibration was caused by the backward rotating cavitation. This paper provides details on the occurrence of backward rotating cavitation in the inducer and its performance.

NTIS

Liquid Propellant Rocket Engines; Turbine Pumps; Cavitation Corrosion; Rotation

20000070359 Colorado Univ., Program in Atmospheric and Oceanic Sciences, Boulder, CO USA

Measurement of ClO and CO2 for ACCENT *Final Report, 1 Mar. 1999 29 Feb. 2000*

Toohey, Darin, Colorado Univ., USA; [2000]; 3p; In English

Contract(s)/Grant(s): NAG2-1306; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Observations have shown that ozone in largely removed in rocket plumes within an hour of launch [M.N. Ross, et al., Nature 390, 62-64, 1997]. Large abundances of chlorine oxide (ClO) were first detected in the fresh plume of a Delta rocket in May of 1998 from the NASA WB-57 during the Air Force RISO campaign by the CORE instrument developed at UC Irvine. Similar abundances were detected a month later in the plume of an ATLAS II rocket. Although the maximum ClO observed in these plumes was twenty-five times larger than the highest values ever observed in the perturbed polar vortices, in a new study, [M.N. Ross, et al., Geophys. Res. Lett., 2000, in press] could not account for observed ozone losses based on known chlorine photochemistry. New measurements were obtained in plumes of Delta, Atlas, and Athena rockets in 1999 during ACCENT with the CORE instrument augmented with a modified LiCor non-dispersed infrared detector for fast-response measurements of carbon-dioxide (CO2). The absolute abundance of this specie constrains the rocket emission stoichiometry, and its relative abundance serves as a tracer of dilution. The combination of ClO and CO2 will provide important new insights into the temporal and spatial evolution of reactive chlorine partitioning and its dependence on rocket motor type.

Derived from text

Rocket Exhaust; Exhaust Gases; Chlorine Oxides; Carbon Dioxide

20000070414 Thiokol Propulsion, Huntsville, AL USA

Wormhole Formation in RSRM Nozzle Joint Backfill

Stevens, J., Thiokol Propulsion, USA; [2000]; 18p; In English, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS8-38100; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The RSRM nozzle uses a barrier of RTV rubber upstream of the nozzle O-ring seals. Post flight inspection of the RSRM nozzle continues to reveal occurrence of "wormholes" into the RTV backfill. The term "wormholes", sometimes called "gas paths", indicates a gas flow path not caused by pre-existing voids, but by a little-understood internal failure mode of the material during motor operation. Fundamental understanding of the mechanics of the RSRM nozzle joints during motor operation, nonlinear viscoelastic characterization of the RTV backfill material, identification of the conditions that predispose the RTV to form wormholes, and screening of candidate replacement materials is being pursued by a joint effort between Thiokol Propulsion, NASA, and the Army Propulsion & Structures Directorate at Redstone Arsenal. The performance of the RTV backfill in the joint is controlled by the

joint environment. Joint movement, which applies a tension and shear load on the material, coupled with the introduction of high pressure gas in combination create an environment that exceeds the capability of the material to withstand the wormhole effect. Little data exists to evaluate why the material fails under the modeled joint conditions, so an effort to characterize and evaluate the material under these conditions was undertaken. Viscoelastic property data from characterization testing will anchor structural analysis models. Data over a range of temperatures, environmental pressures, and strain rates was used to develop a nonlinear viscoelastic model to predict material performance, develop criteria for replacement materials, and quantify material properties influencing wormhole growth. Three joint simulation analogs were developed to analyze and validate joint thermal barrier (back-fill) material performance. Two exploratory tests focus on detection of wormhole failure under specific motor operating conditions. A "validation" test system provides data to "validate" computer models and predictions. Finally, two candidate replacement materials are being screened and "validated" using the developed test systems.

Author

Compressed Gas; Computerized Simulation; Detection; Failure Modes; Gas Flow; O Ring Seals; Rubber; Structural Analysis; Exhaust Nozzles

20000070467 NASA Goddard Space Flight Center, Greenbelt, MD USA

Earth Observing System (EOS) Terra Spacecraft 120 Volt Power Subsystem: Requirements, Development and Implementation

Keys, Denney J., NASA Goddard Space Flight Center, USA; [2000]; 11p; In English; 35th; Intersociety Energy Conversion Engineering, 24-28 Jul. 2000, Las Vegas, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2000-2833; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Built by the Lockheed-Martin Corporation, the Earth Observing System (EOS) TERRA spacecraft represents the first orbiting application of a 120 Vdc high voltage spacecraft electrical power system implemented by the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC). The EOS TERRA spacecraft's launch provided a major contribution to the NASA Mission to Planet Earth program while incorporating many state of the art electrical power system technologies to achieve its mission goals. The EOS TERRA spacecraft was designed around five state-of-the-art scientific instrument packages designed to monitor key parameters associated with the earth's climate. The development focus of the TERRA electrical power system (EPS) resulted from a need for high power distribution to the EOS TERRA spacecraft subsystems and instruments and minimizing mass and parasitic losses. Also important as a design goal of the EPS was maintaining tight regulation on voltage and achieving low conducted bus noise characteristics. This paper outlines the major requirements for the EPS as well as the resulting hardware implementation approach adopted to meet the demands of the EOS TERRA low earth orbit mission. The selected orbit, based on scientific needs, to achieve the EOS TERRA mission goals is a sun-synchronous circular 98.2degree inclination Low Earth Orbit (LEO) with a near circular average altitude of 705 kilometers. The nominal spacecraft orbit is approximately 99 minutes with an average eclipse period of about 34 minutes. The scientific goal of the selected orbit is to maintain a repeated 10:30 a.m. +/- 15 minute descending equatorial crossing which provides a fairly clear view of the earth's surface and relatively low cloud interference for the instrument observation measurements. The major EOS TERRA EPS design requirements are single fault tolerant, average orbit power delivery of 2, 530 watts with a defined minimum lifetime of five years (EOL). to meet these mission requirements, while minimizing mass and parasitic power losses, the EOS TERRA project relies on 36, 096 high efficiency Gallium Arsenide (GaAs) on Germanium solar cells adhered to a deployable flexible solar array designed to provide over 5,000 watts of power at EOL. to meet the eclipse power demands of the spacecraft, EOS TERRA selected an application of two 54-cell series connected Individual Pressure Vessel (IPV) Nickel-Hydrogen (NiH2) 50 Ampere-Hour batteries. All of the spacecraft observatory electrical power is controlled via the TERRA Power Distribution Unit (PDU) which is designed to provide main bus regulation of 120 Vdc +/- -4% at all load interfaces through the implementation of majority voter control of both the spacecraft's solar array sequential shunt unit (SSU) and the two battery bi-directional charge and discharge regulators. This paper will review the major electrical power system requirement drivers for the EOS TERRA mission as well as some of the challenges encountered during the development, testing, and implementation of the power system. In addition, spacecraft test and early on orbit performance results will also be covered.

Author

Spacecraft Power Supplies; Nickel Hydrogen Batteries; Terra Spacecraft

20000072419 Thiokol Propulsion, Brigham City, UT USA

Illustrations for Revision of Chapters 14 and 15 in Elements of Propulsion

Boardman, T., Thiokol Propulsion, USA; Dec. 03, 1999; 6p; In English

Contract(s)/Grant(s): NAS8-97238; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents illustrations of Reusable Solid Rocket Motors (RSRM) nozzle configurations. RSRM nozzle characteristics and components are also included.

CASI

Reusable Rocket Engines; Nozzle Design; Nozzle Geometry; Solid Propellant Rocket Engines; Propulsion

20000072420 Thiokol Propulsion, Brigham City, UT USA

NARC Rayon Replacement Program for the Space Shuttle Reusable Solid Rocket Motor Nozzle: Screening Summary

Cook, R. V., Thiokol Propulsion, USA; Fairbourn, M. W., Thiokol Propulsion, USA; Wendel, G. M., Thiokol Propulsion, USA; [2000]; 8p; In English; 36th; Joint Propulsion, 16-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS8-38100; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Thiokol Corporation and NASA MSFC are jointly developing a replacement for North American Rayon Corporation (NARC) Aerospace Grade Rayon (1650/720 continuous filament), the precursor for the Carbon Cloth Phenolic (CCP) ablatives used in the Space Shuttle Reusable Solid Rocket Motor (RSRM) Nozzles. NARC discontinued production of Aerospace Grade Rayon in September 1997. NASA maintains a stockpile of NARC Rayon to support RSRM production through the summer of 2005. The program plan for selection and qualification of a replacement for NARC rayon was approved in August 1998. Screening activities began in February 1999. The intent of this paper is to provide a summary of the data generated during the screening phase of the NARC Rayon Replacement Program. Twelve cellulose based fibers (rayon and lyocell) were evaluated. These fibers were supplied by three independent vendors. Many of these fibers were carbonized by two independent carbonizers. Each candidate was tested according to standard acceptance test methods at each step of the manufacturing process. Additional testing was performed with the candidate CCPS, including hot fire tests, Process studies and mechanical and thermal characterization. Six of the twelve fiber candidates tested were dropped at the conclusion of Phase 1. The reasons for the elimination of these candidates included; difficulties in processing the material in the whitegoods, carbon and CCP forms; poor composite mechanical performance; and future availability concerns. The remaining six fibers demonstrated enough promise to merit continued evaluation and optimization of the CCP fabrication process. Note: Certain CCP data falls under the restrictions of US export laws, (ITAR, etc.) and will not be included in this paper.

Author

Ablative Materials; Rayon; High Temperature Tests; Mechanical Properties; Carbon-Phenolic Composites

20000072423 NASA Marshall Space Flight Center, Huntsville, AL USA

Flow Analysis of X-34 Main Propulsion System Feedlines

Vu, Bruce, American Inst. of Aeronautics and Astronautics, USA; Garcia, Robert, American Inst. of Aeronautics and Astronautics, USA; [2000]; 10p; In English; 36th; 36th Joint Propulsion Conference, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2000-3722; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

The X-34 Main Propulsion System (MPS) configuration includes the liquid oxygen (LOX) and rocket propellant #1 (RP-1) feedlines. The flow analyses of these feedlines were performed and documented in previous studies. These analyses predicted a relatively low inlet distortion and nearly even flow split at the engine interface. The new design for these MPS feedlines has been recommended recently. The new configuration includes a tighter radius in the RP-1 feedline and a neck-down section between the gimbals. Conversely, the LOX feedline is very similar to the previous design. There were concerns that this new RP-1 configuration might generate a greater flow distortion at the engine interface than the original design. to resolve this issue, a Computation Fluid Dynamics (CFD) analysis was conducted to determine the flow Field in the new RP-1 feedlines.

Author

X-34 Reusable Launch Vehicle; Feed Systems; Rocket Propellants; Systems Engineering

20000073215 NASA Marshall Space Flight Center, Huntsville, AL USA

Overview of Advanced Space Propulsion Activities in the Space Environmental Effects Team at MSFC

Edwards, David, NASA Marshall Space Flight Center, USA; Carruth, Ralph, NASA Marshall Space Flight Center, USA; Vaughn, Jason, NASA Marshall Space Flight Center, USA; Schneider, Todd, NASA Marshall Space Flight Center, USA; Kamenetzky, Rachel, NASA Marshall Space Flight Center, USA; Gray, Perry, Native American Services, USA; [2000]; 1p; In English; 11th; 11th Advanced Propulsion Workshop, 31 May - 2 Jun. 2000, Pasadena, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Exploration of our solar system, and beyond, requires spacecraft velocities beyond our current technological level. Technologies addressing this limitation are numerous. The Space Environmental Effects (SEE) Team at the Marshall Space Flight Center

(MSFC) is focused on three discipline areas of advanced propulsion; Tethers, Beamed Energy, and Plasma. This presentation will give an overview of advanced propulsion related activities in the Space Environmental Effects Team at MSFC. Advancements in the application of tethers for spacecraft propulsion were made while developing the Propulsive Small Expendable Deployer System (ProSEDS). New tether materials were developed to meet the specifications of the ProSEDS mission and new techniques had to be developed to test and characterize these tethers. Plasma contactors were developed, tested and modified to meet new requirements. Follow-on activities in tether propulsion include the Air-SEDS activity. Beamed energy activities initiated with an experimental investigation to quantify the momentum transfer subsequent to high power, 5J, ablative laser interaction with materials. The next step with this experimental investigation is to quantify non-ablative photon momentum transfer. This step was started last year and will be used to characterize the efficiency of solar sail materials before and after exposure to Space Environmental Effects (SEE). Our focus with plasma, for propulsion, concentrates on optimizing energy deposition into a magnetically confined plasma and integration of measurement techniques for determining plasma parameters. Plasma confinement is accomplished with the Marshall Magnetic Mirror (M3) device. Initial energy coupling experiments will consist of injecting a 50 amp electron beam into a target plasma. Measurements of plasma temperature and density will be used to determine the effect of changes in magnetic field structure, beam current, and gas species. Experimental observations will be compared to predictions from computer modeling.
Author
Aerospace Environments; Solar System; Spacecraft Propulsion; Magnetic Effects

20000073310 Department of Defense, Office of the Inspector General, Arlington, VA USA
Quick-Reaction Report on the Management of the Titan IV Solid Rocket Motor Upgrade Subcontract
Sep. 02, 1992; 20p; In English
Report No.(s): AD-A377515; IG/DOD-92-132; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Air Force's Titan IV is an unmanned, expendable launch vehicle that complements the space shuttle and ensures access to space for certain national security payloads. Martin Marietta's Titan IV Solid Rocket Motor Upgrade (SRMU) subcontract with Hercules is intended to increase reliability, increase performance to launch larger payloads, reduce solid rocket motor cost growth, and eliminate solid rocket motor asbestos and launch waivers. Development and production of SRMU units began in October 1987 with a subcontract price of $ * million for the initial * production units. Despite the original assessments by the Air Force, Martin Marietta and Hercules that SRMU development was low risk, the program has experienced significant technical problems and delays.
DTIC
Solid Propellant Rocket Engines; Titan 4 Launch Vehicle; Spacecraft Reliability

20000073703 Naval Postgraduate School, Monterey, CA USA
Optimization Procedure for Electric Propulsion Engines
De Bellis, John J.; Dec. 1999; 91p; In English
Report No.(s): AD-A374329; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
This thesis addresses the optimization of all types of space electrical propulsion thrusters. From the Langmuir-Irving payload mass fraction formulation, a "dual-optimum" solution is defined, yielding a minimum overall mass for a specified payload consistent with minimum transfer time. This solution fixes the ideal payload mass ratio ($m(pl / mo)$) at a value of 0.45, establishing the ratios of effective exhaust velocity ($v / V(c)$) and incremental change of vehicle velocity ($deltau / V(c)$) to characteristic velocity at 0.820 and 0.327 respectively. The characteristic velocity ($V(c)$) includes thrust time as well as engine efficiency ($eta(t)$) and specific power (alpha). A range of mass ratios from 0.35 to 0.55 is used in order to allow the system designer some flexibility while remaining close to optimal. Nine examples are presented which demonstrate that mission profiles can be optimized by profile-to-thruster matching. A comprehensive list of currently available electric propulsion engines is provided. This list details important parameters such as the specific power, which "sizes" an engine in terms of power provided to the thruster at the cost of additional mass. Allowance is, also made for a fuel tank mass penalty, and examples show that this can also noticeably influence the optimum design.
DTIC
Electric Propulsion; Spacecraft Propulsion; Design Analysis; Propulsion System Performance

20000074095 Auburn Univ., Space Power Inst., AL USA
POwer WithOut Wire (POWOW): A SEP Concept for Space Exploration
Brandhorst, Henry W., Jr., Auburn Univ., USA; ONeill, Mark, Entech, Inc., USA; [2000]; 1p; In English; 51st; 51st International Astronautical Congress, 2-6 Oct. 2000, Rio de Janeiro, Brazil; No Copyright; Avail: Issuing Activity; Abstract Only

Electric propulsion has emerged as a cost-effective solution to a wide range of satellite applications. Deep Space 1 demonstrated electric propulsion as a primary propulsion source for a spacecraft. The POwer WithOut Wires (POWOW) concept has been developed as a solar electric propelled spacecraft that would travel to Mars, for example, enter selenosynchronous orbit and then use lasers to beam power to surface installations. This concept has been developed with industrial expertise in high efficiency solar cells, advanced concentrator modules, innovative arrays, and high power electric propulsion systems. The paper will present the latest version of the spacecraft, the technologies involved, possible missions and trip times to Mars and laser beaming options. The POWOW spacecraft is a general purpose solar electric propulsion system that includes technologies that are directly applicable to commercial and government spacecraft with power levels ranging from 4 kW in Low Earth Orbits (LEO) to about 1 MW. The system is modular and expandable. Learning curve costing methodologies are used to demonstrate cost effectiveness of a modular system.

Author

Solar Electric Propulsion; Space Exploration; Solar Power Satellites

20000074112 Alabama A & M Univ., Dept. of Mechanical Engineering, Huntsville, AL USA

Preliminary Analysis and Design of a Rocket Based Combined Cycle for Efficient Access to Space

Harris, Lawanna, Alabama A & M Univ., USA; Barboka, James, Alabama A & M Univ., USA; Rojas–Oviedo, Ruben, Alabama A & M Univ., USA; Deng, Z. T., Alabama A & M Univ., USA; 20000719; 1p; In English; 36th; 36th Joint Propulsion Conference, 17-19 Jul. 2000, Huntsville, AL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright Waived; Avail: Issuing Activity; Abstract Only

Access to space is presently limited by cost. The cost of delivering a payload to low earth orbit (LEO) is on average $10,000 per pound of payload, in the USA. Much of this cost is incurred from the operation of vehicles developed with 30-40 year old technology. The old technology and design practices have resulted in expensive hardware and intensive maintenance requirements for current launch vehicles. In order to alleviate the cost factor, the technological advances throughout the next millennium must bring affordable development and a new invigorating desire to space exploration. National Aeronautical and Space Administration (NASA), Department of Defense (DOD), and private industry are addressing this issue by focusing on incremental improvements in the Earth- to Orbit (ETO) costs. These improvements have investigated two different approaches: 1) make space vehicles as inexpensive as possible (i.e. Evolved Expendable Launch Vehicle (EELV) and Delta IV) 2) make space vehicles as reusable as airplanes so that the initial cost of investment can be recaptured (i.e. Reusable Launch Vehicle (RLV), X-33, X-34, and X-37) These programs have made notable progress in new material, propulsion, structures, and avionics technologies, during the last 3-5 years. So far, these programs are targeted to reduce present costs by, as much as, five times the current cost. The year 2025 goal for continued space advancement is to have ETO costs reduced by a factor of ten (i.e., tenfold), as low as $100 - $200/lb payload. For the RLV, this goal translates into very low maintenance costs and higher expected reliability per flight must be obtained. Therefore, making higher launch rates possible. For the expendable vehicle, the cost of maintenance cost is minimal, but a greater reliability must exist to insure the payload; since, there would be no way to recover the payload if the mission was to an abort or failure. Overall the cost of vehicle, payload and operations of an expendable may be too high compared to those of the RLV.

Author

Rocket-Based Combined-Cycle Engines; Payloads; Low Earth Orbits; Operating Costs; Avionics

23
CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see categories 24 through 29. For astrochemistry see category 90 Astrophysics.

20000069859 Science Applications International Corp., Reston, VA USA

Durable/Cleanable Coating Technologies Program, Developmental Activities *Final Report, 1 Sep. 1997-21 Mar 1999*

Chiles, Gary W., Science Applications International Corp., USA; VanMullem, Janice, Science Applications International Corp., USA; Mar. 1999; 34p; In English

Contract(s)/Grant(s): F33615-95-D-5615; AF Proj. 4349

Report No.(s): AD-A377602; AFRL-ML-WP-TR-1999-4083; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The U.S. Air Force is interested in obtaining aircraft coatings that exhibit superior performance properties when compared to currently available coating systems. The current technology uses low gloss, polyurethane coatings to provide color and environ-

mental protection for its aircraft. These topcoats must maintain their low gloss and color properties after years of environmental exposure. Two characteristics, namely durability and cleanability, have been difficult to achieve in commercially available coatings. The three Task E vendors did not achieve significant improvements in durability or cleanability as desired. At the end of their approximately 6-month research and development efforts, which was cut slightly short due to budget constraints, only Hentzen coatings prepared a product that performed marginally better than other formulations submitted for characterization at Battelle Columbus. It is possible that better formulations may have been achieved if additional time was provided to the vendors. USM reported that, if they had been able to develop the coating system based on fluoropolymer technology, significant improvements may have been achieved. Likewise, Hart Polymers felt that had they been allowed additional time for research, color, gloss and solvent resistance issues would have been resolved.

DTIC

Durability; Protective Coatings; Cleaning; Armed Forces (USA); Aerospace Planes

20000070327 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

HPSEC Analysis of Ester-Based Polyurethane Rubber Materials *Final Report, Nov. 1997-Jul. 1998*

Napadensky, Eugene; Hagnauer, Gary L.; Kinkennon, Amy; Rorabaugh, Donald T.; Apr. 2000; 33p; In English

Report No.(s): AD-A377745; ARL-TR-2201; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The work described in this report contributes to a larger study conducted by the U.S. Army Tank-automotive and Armaments Command (TACOM) at Picatinny Arsenal, NJ, to evaluate the environmental and operational stability of candidate commercial polyester-polyurethane rubber materials for possible fuel bladder and containment applications. High-performance size-exclusion chromatography (HPSEC) techniques are employed to analyze and help understand the effects of accelerated environmental exposure on the average molecular weights (MW) and molecular weight distributions (MWD) of the rubber in selected test specimens. A special test method and sample preparation procedures to extract and isolate the soluble polymer in test specimens from coating, interlayer, fabric, and carbon reinforcement components are described. HPSEC separates polymer molecules according to their relative "sizes" in solution and therefore is very useful in studying rubber reversion and estimating the extent of polymer degradation due to chain scission processes. Exposure to elevated temperature and moisture content (percent relative humidity) accelerate sample degradation. As the aging time and severity of aging conditions increase, gel formed during the early stages of exposure disappears and the MW of soluble materials continues to decrease. The chemical mechanism for polymer chain degradation and possible cause and consequences of the gelation effect are discussed.

DTIC

Polyurethane Resins; Rubber; Chromatography

20000072494 Massachusetts Inst. of Tech., Dept. of Chemical Engineering, Cambridge, MA USA

Processing and Deposition of Nanocrystalline Oxide Composites for Thermal Barrier Coatings *Progress Report, 1 Jan.-31 Mar. 2000*

Ying, Jackie Y.; McCue, Justin T.; Mar. 31, 2000; 8p; In English

Contract(s)/Grant(s): N00014-95-1-0626

Report No.(s): AD-A377008; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report describes the thermal stability and electrical conductivity of nanocrystalline oxide composites for thermal barrier coating applications. Electrophoretic deposition was used to coat the nanocomposite powders onto nickel substrates. The effect of alumina content, powder calcination temperature, and film thickness on the thermal stability of zirconia-based coatings was examined. It was found that a small addition of alumina (5 wt%) and high calcination temperatures (1300 C) enhanced the thermal stability of the coatings. Additionally, 50 micron-thick coatings were more thermally stable than thinner coatings. The electrical conductivity of the powders was also measured to determine the effect of alumina on oxygen conductivity.

DTIC

Thermal Control Coatings; Electrical Resistivity; Thermal Insulation; Composite Materials; Single Crystals; Thermal Stability; Barrier Layers; Electrophoresis

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20000070411 Boeing Co., Rocketdyne, Canoga Park, CA USA
Metal Matrix Composites for Rocket Engine Applications
McDonald, Kathleen R., Boeing Co., USA; Wooten, John R., Boeing Co., USA; May 16, 2000; 16p; In English; Society of Automotive Engineers Meeting, May 2000, Fort Worth, TX, USA
Contract(s)/Grant(s): NCC8-155; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
     This document is from a presentation about the applications of Metal Matrix Composites (MMC) in rocket engines. Both NASA and the Air Force have goals which would reduce the costs and the weight of launching spacecraft. Charts show the engine weight distribution for both reuseable and expendable engine components. The presentation reviews the operating requirements for several components of the rocket engines. The next slide reviews the potential benefits of MMCs in general and in use as materials for Advanced Pressure Casting. The next slide reviews the drawbacks of MMCs. The reusable turbopump housing is selected to review for potential MMC application. The presentation reviews solutions for reusable turbopump materials, pointing out some of the issues. It also reviews the development of some of the materials.
CASI
Engine Parts; Metal Matrix Composites; Turbine Pumps; Spacecraft Construction Materials

20000070837 West Virginia Univ., Constructed Facilities Center, Morgantown, WV USA
Evaluation of a New Rehabilitation Technology for Bridge Piers with Composite Materials *Final Report*
Lopez–Anido, R.; Gupta, R.; Gangarao, H. V. S.; Halabe, U. B.; Kshirsagar, S.; Jun. 1999; 92p; In English
Report No.(s): PB2000-103402; No Copyright; Avail: National Technical Information Service (NTIS)
     This study evaluated a bridge rehabilitation technology using glass fiber-reinforced fabric encasing on deteriorated bridge columns and piers. Results of accelerated tests under sustained showed significant increase in compressive strengths with one- or two-layer composite wraps. A predictive model for wrapped concrete cylinders was developed and validated with experimental data. The composite bon integrity under various environmental conditions was evaluated and monitored by nondestructive test methods and thermal analysis. The composite fabric rehabilitation technology was field tested on Pond Creek Road Bridge in Wood County, West Virginia.
NTIS
Wharves; Composite Wrapping; Composite Materials; Bridges (Structures)

20000070863 NASA Marshall Space Flight Center, Huntsville, AL USA
Nondestructive Characterization Techniques Used for Ceramic Matrix Composite Life Determination
Effinger, Michael, NASA Marshall Space Flight Center, USA; Koenig, John, Southern Research Inst., USA; Ellingson, Bill, Argonne National Lab., USA; Spohnholtz, Todd, Argonne National Lab., USA; [2000]; 1p; In English; Integrated High Payoff Turbine Engine, 11-13 Sep. 2000, Dayton, OH, USA; No Copyright; Avail: Issuing Activity; Abstract Only
     Recent results indicate that the specific damping capacity and resonant frequency measurements taken periodically during a component's lifetime is able to quantify the mechanical fatigue of CMCS. This gives hope for the potential of determining the actual and residual life of CMC materials using a combination of nondestructive techniques. If successful, then this new paradigm for life prediction of CMCs could revolutionize the approach for designing and servicing CMC components, thereby significantly reducing costs for design, development, health monitoring, and maintenance of CMC components and systems. The Nondestructive Characterization (NDC) life prediction approach would complement life prediction using micromechanics and continuum finite element models. This paper reports on the initial concept of NDC life prediction, a review of the C/SiC blisk damping data, and how changes in the specific damping capacity & ultrasonic elastic modulus data have established the concept as a possibility.
Author
Nondestructive Tests; Damping; Resonant Frequencies; Frequency Measurement; Ceramic Matrix Composites

20000072881 NASA Marshall Space Flight Center, Huntsville, AL USA
Growth of Carbon Nanostructure Materials Using Laser Vaporization
Zhu, Shen, Universities Space Research Association, USA; Su, Ching–Hua, NASA Marshall Space Flight Center, USA; Lehozeky, S., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 11th; 11th European Conference, 3-8 Sep. 2000, Porto, Portugal; No Copyright; Avail: Issuing Activity; Abstract Only

Since the potential applications of carbon nanotubes (CNT) was discovered in many fields, such as non-structure electronics, lightweight composite structure, and drug delivery, CNT has been grown by many techniques in which high yield single wall CNT has been produced by physical processes including arc vaporization and laser vaporization. In this presentation, the growth mechanism of the carbon nanostructure materials by laser vaporization is to be discussed. Carbon nanoparticles and nanotubes have been synthesized using pulsed laser vaporization on Si substrates in various temperatures and pressures. Two kinds of targets were used to grow the nanostructure materials. One was a pure graphite target and the other one contained Ni and Co catalysts. The growth temperatures were 600-1000 C and the pressures varied from several torr to 500 torr. Carbon nanoparticles were observed when a graphite target was used, although catalysts were deposited on substrates before growing carbon films. When the target contains catalysts, carbon nanotubes (CNT) are obtained. The CNT were characterized by scanning electron microscopy, x-ray diffraction, optical absorption and transmission, and Raman spectroscopy. The temperature-and pressure-dependencies of carbon nanotubes' growth rate and size were investigated.

Author

Carbon; Nanostructure (Characteristics); Pulsed Lasers; Vaporizing; Crystal Growth

20000073708 Delaware Univ., Center for Composite Materials, Newark, DE USA

Composites 2000: An International Symposium on Composite Materials

Oct. 08, 1999; 46p; In English

Report No.(s): AD-A374357; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Composites 2000: An International Symposium on Composite Materials" commemorates the 25th anniversary of the University of Delaware Center for Composite Materials. The objective of the symposium is to highlight advances in composite materials and manufacturing processes by bringing together worldwide leaders in the field of composites to share their extensive knowledge of these topics with representatives of industry, government, and academia. The technical program comprises papers in four theme areas: Mechanics and Design, Materials and Synthesis, Processing Science, and Performance and Durability. Coverage of the current state of the art is complemented by the provision of insight into the future of advanced composites for the next millennium. These topics were selected based on the philosophy that processing creates microstructure, which determines properties; in turn, properties coupled with environment determine performance, while the objective of design is to predict the effects of all of these interrelated variables. This philosophy has formed the foundation of the Center's research program for much of the past quarter century, and it permeates the technical program of the International Symposium on Composite Materials.

DTIC

Composite Materials; Conferences; Manufacturing; Composite Structures

20000074117 NASA Marshall Space Flight Center, Huntsville, AL USA

Nanotechnology Concepts at MSFC: Engineering Directorate

Bhat, Biliyar, NASA Marshall Space Flight Center, USA; Kaul, Raj, NASA Marshall Space Flight Center, USA; Shah, Sandeep, NASA Marshall Space Flight Center, USA; Smithers, Gweneth, NASA Marshall Space Flight Center, USA; Watson, Michael D., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Microgravity Materials Science Conference, 6-8 Jun. 2000, Huntsville, AL, USA; Sponsored by NASA Marshall Space Flight Center, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Nanotechnology is the art and science of building materials and devices at the ultimate level of finesse: atom by atom. Our nation's space program has needs for miniaturization of components, minimization of weight and maximization of performance, and nanotechnology will help us get there. MSFC - Engineering Directorate (ED) is committed to developing nanotechnology that will enable MSFC missions in space transportation, space science and space optics manufacturing. MSFC-ED has a dedicated group of technologists who are currently developing high pay-off nanotechnology concepts. This poster presentation will outline some of the concepts being developed at this time including, nanophase structural materials, carbon nanotube reinforced metal and polymer matrix composites, nanotube temperature sensors and aerogels. The poster will outline these concepts and discuss associated technical challenges in turning these concepts into real components and systems.

Author

Space Manufacturing; Space Programs; Miniaturization; Polymer Matrix Composites

Includes the analysis, synthesis, and use inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see also 34 Fluid Dynamics and Thermodynamics, For astrochemistry see category 90 Astrophysics.

20000069648 Army Construction Engineering Research Lab., Champaign, IL USA

Treatment of Volatile Organic Compounds From Gas Streams Using a Three-Phase Circulating-Bed Biofilm Reactor
Final Report

Kim, Byung J.; Yu, Haibo; Rittmann, Bruce E.; Apr. 2000; 100p; In English
Report No.(s): AD-A377606; ERDC/CERL,TR-00-9; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

   This study focuses on the biofilm kinetics of removing benzene, toluene, and p-xylene (BTX) from gas streams in a three-phase circulating-bed reactor using porous carriers. In the biofilm reactor, gas-liquid equilibrium existed for BTX, but not for oxygen. Oxygen was consumed as a cosubstrate in the oxygenation reactions and the terminal electron acceptor during respiration. When toluene was the sole substrate, oxygen mostly controlled its removals, and toluene inhibition mostly controlled the removals of the toluene intermediate. With increased toluene or decreased oxygen loading, more toluene intermediate was removed inside the biofilm, and the intermediate mass flux changed in direction from out-of to into the biofilm. The mass transfer resistance in the biofilm relieved the intermediate from toluene inhibition. However, higher biofilm accumulation showed adverse effects on reactor performance due to increased demand for oxygen for respiration. The suspended biomass contributed to the removals of toluene and its intermediate and played its most important role when oxygen limitation was significant When toluene/benzene or toluene/p-xylene were removed simultaneously, their inhibition forced more volatile organic compounds to be removed inside the biofilm, where mass transfer resistance relieved the inhibition effects. The removal efficiencies for the lower-concentration compound were smaller.
DTIC
Acceptor Materials; Toluene; Benzene; Gas Flow

20000069802 Johns Hopkins Univ., Chemical Propulsion Information Agency, Columbia, MD USA

JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting, Volume 1*, 11 Dec. 1998 - 18 Oct. 1999*

Fry, Ronald S., Editor, Johns Hopkins Univ., USA; Gannaway, Mary T., Editor, Johns Hopkins Univ., USA; October 1999; 232p; In English; 24th; 36th; Airbreathing Propulsion, 18-21 Oct. 1999, Cocoa Beach, FL, Cocoa Beach, FL, USA, USA; Sponsored by NASA, USA; See also 20000069803 through 20000069818
Contract(s)/Grant(s): SPO700-97-D-4004
Report No.(s): CPIA-Publ-692-Vol-1; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

   Volume 1, the first of three volumes is a compilation of 16 unclassified/unlimited-technical papers presented at the Joint Army-Navy-NASA-Air Force (JANNAF) 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee held jointly with the 181 Propulsion Systems Hazards Subcommittee. The meeting was held on 18-21 October 1999 at NASA Kennedy Space Center and The DoubleTree Oceanfront Hotel, Cocoa Beach, Florida. Topics covered include overviews of RBCC and PDE hypersonic technology, Hyper-X propulsion ground testing, development of JP-8 for hypersonic vehicle applications, numerical simulation of dual-mode SJ combustion, V&V of M&S computer codes, MHD SJ and Rocket Based Combined Cycle (RBCC) launch vehicle concepts, and Pulse Detonation Engine (PDE) propulsion technology development including fundamental investigations, modeling, aerodynamics, operation and performance.
Author
Air Breathing Engines; Propulsion System Performance; Computational Fluid Dynamics; Wind Tunnel Tests; Supersonic Combustion

20000069809 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA

Computational and Modeling Constraints for LES of Turbulent Combustion

Menon, S., Georgia Inst. of Tech., USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 73-90; In English; See also 20000069802; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

   The next generation gas turbine engine are required to significantly reduce pollutant emission and be also fuel-efficient. Accurate prediction of pollutant formation requires proper resolution of the spatio-temporal evolution of the unsteady mixing and combustion processes. Conventional steady state methods are not able to deal these features. Methodology based on large-eddy

simulations (LES) has become a viable method for studying such unsteady reacting flows. However, for LES to be used successfully, careful considerations are required in order to ensure that the methodology is capable of providing reliable data. This implies special constraints on the accuracy of the numerical scheme and on the physics simulated and modeled within the LES model. This paper discusses these issues and then, as an example, describes a new LES methodology developed for both single and two-phase reacting flows that has demonstrated its accuracy by simulating correctly reacting turbulent flows in both laboratory scale and full-scale gas turbine combustors. A key feature of this new solver is the manner in which small-scale turbulent mixing and combustion is simulated. This feature allows proper characterization of the effects of both largescale convection and small-scale mixing on the scalar processes thereby, providing a more accurate prediction of chemical reaction effects. Comparison with experimental data confirm the accuracy of the new simulation too[which is now being used to study spray combustion in full-scale gas turbine combustors.

Author

Combustion Physics; Gas Turbine Engines; Large Eddy Simulation; Computational Fluid Dynamics; Mathematical Models; Turbulent Mixing

20000069815 California Univ., San Diego, La Jolla, CA USA

Fundamental Investigations of Pulse-Detonation Phenomena

Williams, Forman A., California Univ., San Diego, USA; Hanson, Ronald K., Stanford Univ., USA; Segal, Corin, Florida Univ., USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 151-161; In English; See also 20000069802

Contract(s)/Grant(s): N00014-99-1-0745; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

    A project has been initiated for obtaining the fundamental information needed for developing pulse detonation engines with tailored injection and variable frequency for propulsion. Pulse-detonation engines are attractive from the viewpoint of cycle performance for airbreathing propulsion of long-range, high-speed missiles, but realization of this potential requires improved understanding of liquid-fuel injection and atomization processes, ignition mechanisms and ignition times, transition to detonation, detonation structure and stability, necessary inlet and nozzle integration, required diagnostic methods and sensors, and adaptive and active control of multitube motors at variable frequency. The research to be reported here addresses these fundamental aspects as they would apply to a single power plant that can effect takeoff from ground or sea bases, accelerate to speeds in excess of Mach 4 and sustain propulsion for ranges in excess of 500 rim. The project is a cooperative effort among UCSD, Stanford and the University of Florida. There is research on supersonic inlets and detonation augmentation by high-energy-density fuels at Florida, on injection, atomization, ignition and diagnostics at Stanford and on detonation propagation, control of injection and of firing and on full and reduced chemistry for ignition, including different possible detonation-augmentation strategies, at UCSD. The primary fuel addressed in these studies is JP-10, although it is planned to consider other possible fuels as well. Experimental, theoretical and computational approaches are employed in this research. The paper presents preliminary results, mainly from Stanford and UCSD, particularly concerning ignition processes.

Author

Detonation; Air Breathing Engines; Fuel Injection; Propulsion System Performance; Liquid Fuels; Pulsed Jet Engines

20000069817 California Inst. of Tech., Pasadena, CA USA

Investigation of Deflagration to Detonation Transition for Application to Pulse Detonation Engine Ignition Systems

Schultz, E., California Inst. of Tech., USA; Wintenberger, E., California Inst. of Tech., USA; Shepherd, J., California Inst. of Tech., USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 175-202; In English; See also 20000069802

Contract(s)/Grant(s): NAS8-97291; N00014-99-1-0744; 1686-ONR-0744; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

    A key issue in pulse detonation engine development is a low-energy initiation system that produces a short run-up distance to detonation and has reproducible shot-to-shot performance. Current practice in designing detonation initiation systems based on deflagration-to-detonation transition is highly empirical and no design guidelines are available. One of the objectives of the ONR MURI program on pulse detonation engines is developing an understanding of initiation which can be used in engine design. We report on a preliminary study of detonation initiation within a 38 mm diameter tube using spark ignition and a Schelkin spiral. A series of experiments have been performed with hydrogen, ethylene, and propane fuels mixed with oxygen and diluents including argon, carbon dioxide, helium, and nitrogen. The time required for detonation development has been measured as a func-

tion of fuel type, equivalence ratio, initial pressure, diluent type, and diluent concentration. The relationship of the initiator performance to the detonation and deflagration characteristics of each mixture is examined.
Author
Deflagration; Detonation; Ignition Systems; Spark Ignition; Pulsed Jet Engines

20000069838 National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA
Reduced-Scale Experiments to Characterize the Suppression of Rack-Storage Commodity Fires
Hamins, A.; McGrattan, K.; Nov. 1999; 44p
Report No.(s): PB2000-101019; NISTIR-6439; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    A series of reduced-scale experiments were conducted to investigate the burning and water suppression of rack-storage commodity fires. The objective of the research is to support the NIST Fire Dynamics Simulator (FDS), a computational fluid dynamics model that endeavors to predict fire growth, spread, sprinkler activation, and suppression by water in rack-storage commodity fires. The model requires appropriate and implementable sub-grid algorithms that adequately represent the full-scale heat and mass transfer that occurs in a warehouse fire with rack-storage of standard commodities. In particular, this report describes experiments that investigated the effect of water application on the time required to achieve ignition of the unburned commodity and on the heat release rate of the burning commodity. Several types of experiments were conducted. These include ignition measurements using the LIFT apparatus and the cone calorimeter, and heat release rate measurements using oxygen consumption calorimetry. All of these measurements were made with and without water application.
NTIS
Computerized Simulation; Fires; Heat Measurement; Heat Transfer

20000070328 Aerospace Corp., El Segundo, CA USA
Annual Progress Report: Surface Chemistry and Tribology of Carbide and Nitride Hard Coatings
Didziulis, S. V.; Frantz, P.; Jan. 20, 2000; 13p; In English
Contract(s)/Grant(s): K-55008/3912
Report No.(s): AD-A377748; AR-ATR-2000(7504)-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    This report summarizes The Aerospace Corporation's efforts in the third year of our AFOSR-funded joint research program with the University of Houston (UH). We completed surface science studies on the interaction of carbon monoxide, ammonia, and a series of small alcohols with the TiC and VC (100) surfaces using high-resolution electron energy-loss spectroscopy (HREELS) and X-ray photoelectron spectroscopy (XPS). We hosted visits by UH personnel, and visited UH twice to perform experiments and discuss results. Our results were presented at two national scientific conferences, and two documents were submitted for publication. Finally, we formulated plans with UH and wrote a proposal for a follow-on three-year program extending this work. Our work is on schedule as outlined in our proposal. The following report is in the format specified by the funding agency for inclusion in the full program report prepared by UH.
DTIC
Surface Reactions; Tribology; Carbides; Nitrides; Coatings

20000070353 NASA Marshall Space Flight Center, Huntsville, AL USA
Use of Computed Tomography for Characterizing Materials Grown Terrestrially and in Microgravity
Gillies, Donald C., NASA Marshall Space Flight Center, USA; Engel, H. P., NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; Materials Science, 8 Jun. 2000, Huntsville, AL, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
    The purpose behind this work is to provide NASA Principal Investigators (PI) rapid information, non-destructively, about their samples. This information will be in the form of density values throughout the samples, especially within slices 1 mm high. With correct interpretation and good calibration, these values will enable the PI to obtain macro chemical compositional analysis for his/her samples. Alternatively, the technique will provide information about the porosity level and its distribution within the sample. Experience gained with a NASA MRD-sponsored Advanced Technology Development (ATD) project on this topic has brought the technique to a level of maturity at which it has become a viable characterization tool for many of the Materials Science PIs, but with equipment that could never be supported within their own facilities. The existing computed tomography (CT) facility at NASA's Kennedy Space Center (KSC) is ideally situated to furnish information rapidly and conveniently to PIs, particularly immediately before and after flight missions.
Author
Microgravity; Computer Aided Tomography; Extraterrestrial Environments; Characterization; Materials Science; Growth

20000070421 Brigham Young Univ., Dept. of Chemistry and Biochemistry, Provo, UT USA

Diaza- 18-Crown-6 Ligands Containing Two Aminophenol Side Arms: New Heterobinuclear Metal Ion Receptors

Su, Ning; Bradshaw, Jerald S.; Zhang, Xian X.; Savage, Paul B.; Krakowiak, Krzysztof E.; Sep. 30, 1999; 7p; In English

Contract(s)/Grant(s): N00014-98-1-0485; 98PR05020-00

Report No.(s): AD-A368653; TR-12; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Three diaza-18-crown-6 ligands substituted with two aminophenol side arms were synthesized as possible heterobinuclear metal ion receptors. Bis(p-aminophenol)-substituted diaza-18-crown-6 ligand (13) was prepared by treating the diazacrown with alpha-bromo-4-nitro-o-cresol in the presence of N,N-diisopropylethylamine followed by reduction of the nitro groups. Bis(o-aminophenol)-substituted diaza-18-crown-6 ligands (11 and 12) were prepared in two steps by the aminomethylation of either an o-nitrophenols or o-(trifluoroacetamido)phenol followed by reduction of the nitro groups or hydrolysis of the trifluoroa-cetamide groups. All new bisphenol-armed diazacrown ligands were purified by ultrasonication in MeOH followed by filtration and drying. Interaction of the ligands with Na(+), K(+), Ag(+), and Cu(2+) was evaluated by a calorimetric titration technique at 25 deg C in MeOH. The complexes of Ag(+) and Cu(2+) are much more stable than those of Na(+) and K(+). Heterobinuclear complexes were observed for 11-Cu(2+)- Na(+) and 12-Cu(2+)-Na(+) but not for 13-Cu(2+)-Na(+) or for 12-Cu(2+)-Ag(+).

DTIC

Ligands; Metal Ions; Amino Acids; Nitrogen Compounds; Bisphenols; Organic Chemistry

20000070512 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Fiscal 1997 report on the results of the R and D on the invention of high-level combustion technology using the microgravity environment

Mar. 31, 1998; 416p; In Japanese; In English

Report No.(s): DE99-718355; ETDE/JP-99718355; No Copyright; Avail: Department of Energy Information Bridge

For the purpose of achieving both the diversification of energy resources and the reduction in environmental pollutants in fuel exhaust gases, the paper conducted elucidation of combustion phenomena using microgravity facilities and research on combustors which make high-level combustion possible. In the experimental study using microgravity experimental facilities, conducted were evaluation experiments on combustion/evaporation of fuel droplets and droplet groups, elucidation/evaluation experiments of combustion characteristics of high-density fuels, evaluation experiments of flammability limit, and elucidation/ evaluation experiments of emission mechanisms of NOx, etc. Analysis/evaluation of the data obtained and elucidation of the combustion mechanism were conducted. Further, by applying the results of the microgravity experiment, the high-level combustor experimental facilities were fabricated, and validation tests were started. In the international joint research with US's NASA, the following were conducted using JAMIC's facilities and NASA's 2.2 second drop tower: study of mutual interference of droplet series combustion, study of binary system fuel droplet series combustion, study of combustion characteristics of solid fuels, study of behavior of flames around the lean flammable limit, etc.

NTIS

Combustion Physics; Fuel Combustion; Combustion Chambers

20000070559 Brigham Young Univ., Dept. of Chemistry and Biochemistry, Provo, UT USA

Synthesis and Aggregate Study of Bisphenol-Containing Diaza- 18-Crown-6 Ligands

Su, Ning; Bradshaw, Jerald S.; Savage, Paul B.; Krakowiak, Krzysztofe E.; Izaft, Reed M.; Sep. 30, 1999; 8p; In English

Contract(s)/Grant(s): N00014-98-1-0485; 98PR05020-00

Report No.(s): AD-A368629; TR-13; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Bisphenol-containing diaza-18-crown-6 ligands (1-16) were synthesized as potential membrane-forming amphiphiles via the one-pot Mannich reaction. Sonication of the crude products in a small amount of MeOH followed by filtration and drying proved to be an efficient method of purifying nearly all compounds. Compounds 8 and 9 were selected for assay as amphiphiles. Compared to simple, alkylated diazacrown ethers, the stability of the amphisomes formed from these monomers is lower possibly because intramolecular hydrogen bonding prevents formation of intermolecular hydrogen bonds.

DTIC

Hydrogen Bonds; Synthesis (Chemistry); Molecular Structure; Chemical Bonds; Bisphenols; Molecular Interactions

20000070758 Geological Survey, Water Resources Div., Nashville, TN USA

Biodegradation of Chlorinated Ethenes at a Karst Site Middle Tennessee

Byl, T. D., Geological Survey, USA; Williams, S. D., Geological Survey, USA; 2000; 70p; In English

Report No.(s): PB2000-105921; USGS/WRI-99-4285; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This report presents results of field and laboratory investigations examining the biodegradation of chlorinated ethenes in a karst aquifer contaminated with trichloroethylene (TCE). The study site, located in Middle Tennessee, was selected because of the presence of TCE degradation byproducts in the karst aquifer and available site hydrologic and chlorinated-ethene information. Additional chemical, biological, and hydrologic data were gathered to evaluate whether the occurrence of TCE degradation byproducts in the karst aquifer was the result of biodegradation within the aquifer or simply transport into the aquifer.
NTIS
Biodegradation; Aquifers; Chlorination; Contamination; Karst; Water Pollution; Pollution Control

20000070799 NASA Marshall Space Flight Center, Huntsville, AL USA
Cryo-Trapping the Distorted Octahedral Reaction Intermediate of Manganese Superoxide Dismutase
Borgstahl, Gloria, NASA Marshall Space Flight Center, USA; Snell, Edward H., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Superoxide dismutase protects organisms from potentially damaging oxygen radicals by catalyzing the disproportion of superoxide to oxygen and hydrogen peroxide. We report the use of cryogenic temperatures to kinetically trap the 6th ligand bound to the active site of manganese superoxide dismutase. Using cryocrystallography and synchrotron radiation, we describe at 1.55A resolution the six-coordinate, distorted octahedral geometry assumed by the active site during catalysis and compare it to the room temperature, five-coordinate trigonal-bipyramidal active site. Gateway residues Tyr34, His30 and a tightly bound water molecule are implicated in closing off the active site and blocking the escape route of superoxide during dismutation.
Author
Distortion; Inorganic Peroxides; Manganese; Chemical Reactions; Cryogenics; Crystallography; Synchrotron Radiation; Octahedrons

20000070850 Colorado Univ., Dept. of Mechanical Engineering, Boulder, CO USA
Buoyancy and Pressure Effects on Bulk Metal-Oxygen Reactions
Abbud–Madrid, A., Colorado Univ., USA; McKnight, C., Colorado Univ., USA; Branch, M. C., Colorado Univ., USA; Daily, J. W., Colorado Univ., USA; [1998]; 8p; In English; 36th; 36th Aerospace Sciences Meeting and Exhibit, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
The combustion behavior of metal-oxygen reactions if a weakly buoyant environment is studied to understand the rate-controlling mechanisms in the homogeneous and heterogeneous combustion of bulk metals. Cylindrical titanium and magnesium specimens are ignited in pure-oxygen at pressures ranging from 0.1 to 4.0 atm. Reduced gravity is obtained from an aircraft flying parabolic trajectories. A weakly buoyant environment is generated at low pressures under normal gravity and also at 1 atm under reduced gravity (0.01g). The similarity between these two experimental conditions comes from the p(exp 2)g buoyancy scale extracted from the Grashof number. Lower propagation rates of the molten interface on titanium samples are found at progressively lower pressures at 1 g. These rates are compared to theoretical results from heat conduction analyses with a diffusion/convection controlled reaction. The close agreement found between experimental and theoretical values indicate the importance values indicate the importance of natural convection enhanced oxygen transport on combustion rates. For magnesium, progressively longer burning times are experienced at lower pressures and 1 g. Under reduced gravity conditions at 1 atm, a burning time twice as long as in 1 g is exhibited. However, in this case, the validity of the p(exp 2)g buoyancy scale remains untested due to the inability to obtain steady gas-phase burning of the magnesium sample at 0.1 atm. Nevertheless, longer burning times and larger flame standoff distance at low pressures and at low gravity points to a diffusion/convection controlled reaction.
Author
Buoyancy; Metal Combustion; Metal-Gas Systems; Oxygen; Pressure Effects; Gas-Metal Interactions

20000072571 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Structure and vibrational spectra of the vapour molecules Fe2Cl6 and AlFeCl6
Akdeniz, Z.; Tosi, M. P.; Aug. 31, 1999; 13p; In English
Melting of aluminium and iron trichloride crystals is accompanied by a structural transition from octahedral to tetrahedral coordination of the metal ions, and a widely accepted interpretation of their liquid structure is that it mainly consists of strongly correlated dimeric units. Such Al2Cl6 and Fe2Cl6 molecules are stable in the vapor phase and coexist in gaseous mixtures together with AlFeCl6 molecules. In this work, we extend to Fe2Cl6 and AlFeCl6 our earlier study of the ionic interactions in Al2Cl6 (see DE99636784), using a model which accounts for ionic deformability through (1) effective valences and (2) electrostatic and

overlap polarizabilities. The main disposable parameters of the model are adjusted to the Fe-CI bond length in the FeCl3 monomer molecule and to the Fe-Fe bond length and a bond-stretching frequency in the Fe2Cl6 molecule. The results are used to evaluate the structure of the AlFeCl6 molecule, which has so far only been inferred from the observed Raman spectrum in mixed vapors. Extensive comparisons with data on molecular vibrational frequencies are also presented for Fe2Cl6 and AlFeCl6.
NTIS
Iron Chlorides; Molecular Structure; Vapors; Vibrational States; Stability; Vibrational Spectra; Aluminum Chlorides; Metal Ions

20000072572 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Theoretical study of the stabilization of the (AlF5)(sup 2-) complex anion by alkali counterions
Akdeniz, Z.; Cicek, Z.; Karaman, A.; Pastore, G.; Tosi, M. P.; Aug. 31, 1999; 11p; In English
Report No.(s): DE99-636783; IC-99/104; No Copyright; Avail: Department of Energy Information Bridge

   We evaluate the relative stability of various states of coordination for the aluminium ion by fluorines in M(n)AlF(n+3) micro-clusters, with M = Li, Na, or K and n = 2 or 3. The calculations use ionic model interactions which have been adjusted and tested against experimental data and ab initio calculations on the (AlF4)(sup -) anion and on MAlF4 clusters. We confirm earlier results showing that the fivefold (AlF5)(sup 2-) anion is stabilized by the counterions and assess the sensitivity of this result to the details of the model as well as the effect of alkali substitution. We evaluate the variation of the breathing mode frequency of the complex anions in these clusters for comparison with Raman scattering data from liquid mixtures of AlF3 and MF in the basic range of composition. 13 refs, 5 tabs
NTIS
Anions; Stability; Numerical Analysis; Stabilization; Alkalies; Aluminum Fluorides

20000072573 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy
Ionic interactions in alkali-aluminium tetrafluoride clusters
Akdeniz, Z.; Cicek, Z.; Karaman, A.; Pastore, G.; Tosi, M. P.; Aug. 31, 1999; 13p; In English
Report No.(s): DE99-636784; IC-99/105; No Copyright; Avail: Department of Energy Information Bridge

   Complex anion structures (AlF4)(sup -), (AlF5)(sup 2-) and (AlF6)(sup 3-) coexist in liquid mixtures of aluminium trifluoride and alkali fluorides in composition-dependent relative concentrations and are known to interact with the alkali counterions. We present a comparative study of the static and vibrational structures of MAlF4 molecules (with M = any alkali), with the aim of developing and testing a refined model of the ionic interactions for applications to the Al-M fluoride mixtures. We find that, whereas an edge-bridged coordination is strongly favored for Li in LiAlF4 , edge-bridging and face-bridging of the alkali ion become energetically equivalent as one moves from Na to the heavier alkalis. This result is sensitive to the inclusion of alkali polar-izability and may be interpreted as implying (for M = K, Rb, or Cs) almost free relative rotations of the M(sup +) and (AlF4)(sup -) partners at temperatures of relevance to experiment. The consistency of such a viewpoint with electron diffraction data on vapors and with Raman spectra on melts is discussed.
NTIS
Ionic Collisions; Fullerides; Aluminum Compounds; Clusters; Vibration; Static Characteristics

20000073232 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Kinetics of the Cl(2)P(J)) + CH4 Reaction: Effects of Secondary Chemistry Below 300 K
Wang, J. J., Jet Propulsion Lab., California Inst. of Tech., USA; Keyser, Leon F., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

   Absolute rate data for the Cl(2)P(J) + CH4 yields HCl + CH3 reaction have been obtained from 218 to 298 K by using the discharge-flow resonance fluorescence technique at I Torr total pressure. The result at 298 K is (10.1 +/- 0.6) x 10(exp -14) cu cm/molecule/s. The temperature dependence in Arrhenius form is (6.5 +/- 0.9) x 10(exp -12) exp[(-1235 +/- 34)/T]. The errors given are one standard deviation; overall experimental error is estimated at +/- 15%. Because of the relatively large disagreement among earlier measurements at low temperatures, the results were examined for possible effects of non-Boltzmann spin distribu-tion and vibrational excitation of CH4, secondary chemistry of CH3 radicals, and impurities in the CH4 source. There was no significant change in the observed rate constant when an efficient spin quencher, CF4, was added and estimates indicate that vibra-tional partitioning in CH4 should be at the ambient reactor temperature before the start of the reaction. The results were also inde-pendent of the source of Cl atoms (microwave discharge or thermal decomposition of Cl2) and whether CH4 was purified in-situ. However, the observed rate constant did depend on initial Cl atom concentrations and to a lesser extent on CH4 concentrations. Numerical simulations were used to assess the importance of secondary chemistry over a range of reactant concentrations
Author
Kinetics; Hydrochloric Acid; Thermal Decomposition; Reaction Kinetics; Methyl Compounds; Resonance Fluorescence

20000073307 Rice Univ., Dept. of Chemistry, Houston, TX USA

Group III Materials: New Phases and Nano-Particles with Applications in Electronics and Optoelectronics

Barron, Andrew R.; Dec. 31, 1999; 6p; In English

Contract(s)/Grant(s): N00014-97-1-0213

Report No.(s): AD-A377550; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objectives of this research are: 1. Demonstrate molecular control for the MOCVD growth of gallium and indium chalcogenides. 2. Demonstrate a molecular model approach to the prediction of suitable binding groups to semiconductor surfaces. 3. Demonstrate the application of surface coordination chemistry to the control over the electronic properties of semiconductor nanoparticles.

DTIC

Organometallic Compounds; Semiconductors (Materials); Metalorganic Chemical Vapor Deposition

20000073791 California Univ., Dept. of Materials Science and Engineering, Los Angeles, CA USA

Physical Chemistry of Sol-Gel Materials Symposium Held during the 213th National Meeting of the American Chemical Society Held in Anaheim, California on March 21-25, 1999 *Final Report, 15 Mar.-30 Sep. 1999*

Dunn, Bruce; May 2000; 34p; In English; Symposium organized for the American Chemical Society, March 1999.

Contract(s)/Grant(s): N00014-99-1-0466

Report No.(s): AD-A376790; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Sol-gel processing has emerged as the preferred route to prepare a variety of highly organized porous and composite material. This talk will present a brief overview of "classical" sol-gel processing followed by a discussion of new approaches that combine sol-gel processing with various templating and self-assembly strategies, enabling control of pore size and pore connectivity and offering the possibility to combine materials into ordered composite architectures. On the molecular scale, "solvent templating" is used to control pore size in the range 0.3 - 0.7-nm needed for applications such as molecular sieving membranes. On the mesoscale, evaporation-reduced self-assembly of surfactant/silica mesophases is used to prepare continuous, mesoporous films. By using micelles to spatially partition and organize organic precursors (within the hydrophobic micellar interiors) and inorganic precursors (surrounding the hydrophilic micellar exteriors) further self-assembly into organic and inorganic precursors into various liquid crystaline mesophases allows simultaneous organization approach can be extended to form nanocomposite constructions. The evaporation-induced self-easily nanostructured particles during aerosol processing and can be generalized to other composite architectures and other materials combinations (e.g. metalloxide). Through co-organization of photosensitive molecules or polymers within ordered mesophases, we can achieve optically-mediated changes in mesostructural order, providing the first evidence of nanostructural lithography.

DTIC

Physical Chemistry; Sol-Gel Processes; Composite Materials; Conferences; Mesoscale Phenomena

20000073794 Electricite de France, Clamart, France

Validation of a Monte Carlo method using a joint PDF of the composition and an ILDM kinetic model for the prediction of turbulent flames

Zurbach, S.; Garreton, D.; Kanniche, M.; Sep. 30, 1997; 44p; In English

Report No.(s): DE99-723875; EDF-98-NB-00006; No Copyright; Avail: Department of Energy Information Bridge

The resolution of the joint probability density function (PDF) of the composition and its application to the calculation of turbulent diffusion flames is presented. The numerical method is based on an Eulerian Monte-Carlo solver coupled with the CFD code Hades; an ILDM kinetic model allows the calculation of the chemical source terms. Two configurations are studied: the Masri-Bilger-Dibble flame and the Delft flame. The first turbulent diffusion flame is close to extinction and is a good test for the prediction of the interactions between the turbulence and the chemicals scales. The second one enables the validation of the prediction of an intermediate species taking a super-equilibrium concentration, the OH radical.

NTIS

Computational Fluid Dynamics; Turbulent Flames; Turbulent Diffusion

20000073812 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Report on the research and development under a consignment from NEDO of high temperature carbon dioxide fixation and utilization technology for fiscal 1996

Mar. 31, 1997; 650p; In Japanese; In English

Report No.(s): DE99-714274; ETDE/JP-99714274; No Copyright; Avail: Department of Energy Information Bridge

For the prevention of global warming, this R and D is aimed at separating/ recovering high temperature CO2 from high temperature gas at 300 C or above and developing technology for effective use of the recovered CO2 as measures taken for reduction in CO2 emissions from the fixed emission sources. In this fiscal year, the following were proceeded with: heightening of separation performance evaluation technology, promotion of technical development of ceramic separation membranes and supports, and development of element technology of modular integration. In the examinational research on separation technology and system optimization, the following were conducted: survey of trends of the technical development, conceptual design of plant and prediction of process behavior, assessment of applicability of the process, and study of effects of utilization/spread of the developmental technology. In the former R and D, borosilicate glass powder rich in alkali is formed on the ring by joining the trially manufactured hollow fiber type membrane and the same form alumina cylinder, and sealing property and strength which stand measurement of permeability were confirmed. In the latter, an innovative process applied with CO2 high temperature separation technology was studied to examine effects of the spread of high temperature gas separation technology.

NTIS

High Temperature Gases; Global Warming; Research and Development

20000074070 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Spectroscopy of Chlorosyl Fluoride, FClO

Mueller, Holger S. P., Cologne Univ., Germany; Cohen, Edward A., Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 1p; In English; 53rd; 53rd Molecular Spectroscopy Symposium, Jun. 1998, Columbus, OH, USA; Sponsored by Ohio State Univ., USA; No Copyright; Avail: Issuing Activity; Abstract Only

FClO has been proposed as an intermediate in reactions involving ClF, Cl2O, and ClF3O, and it has been suggested as a molecule of atmospheric interest. It has been prepared in situ by the hydrolysis of ClF3. The pure rotational spectrum of FClO has been studied by conventional millimeter wave techniques and by microwave Fourier transform spectroscopy. Selected transitions were searched for using predictions based on an analysis of the nu(sub 1) band. FClO is an asymmetric prolate top, kappa = -0.8950 for F(35)ClO, with a rather small dipole component of 0.093 (4) D along the a-axis and a larger one of 1.93 (5) D along the b-axis. Transitions with 0 is less than or equal to J is less than or equal to 54 and 0 is less than or equal to K(sub a) is less than or equal to 18 were observed. Cl hyperfine splitting was generally observable throughout the spectrum with F-19 spin-rotation splitting observable as well in the microwave region. Structural parameters, harmonic force constants, and nuclear magnetic shielding parameters were derived and will be compared with data of related molecules, such as ClF3, ClF, FClO2, and FClO3. High resolution infrared spectra were taken in the regions of the FCl stretching mode and bending mode around 600 and 310/cm, respectively. A preliminary analysis indicates that the FCl stretch, near 596.86/cm for F(35)ClO, is in resonance with the dark overtone of delta near 617/cm. A brief progress report will be given.

Author

Millimeter Waves; Microwave Spectra; Fourier Transformation; Spectroscopy

20000074116 NASA Marshall Space Flight Center, Huntsville, AL USA

Experimental and Computational Studies of the Control of Convection of Non-Conducting Liquids During solidification by Means of a Magnetic Field Gradient

Seybert, C. D., California Univ., USA; Evans, J. W., California Univ., USA; Leslie, F., NASA Marshall Space Flight Center, USA; Jones, W. K., Jr., Motorola, Inc., USA; [2001]; 1p; In English; 39th; 39th Aerospace Sciences Meeting, 9 Jan. 2000, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright Waived; Avail: Issuing Activity; Abstract Only

The elimination of convection is essential in experimental investigations of diffusive transport (of heat and matter) during solidification. One classical approach to damping convection in a conducting liquid is the application of a magnetic field. The damping phenomenon is the induction, by the motion of a conductor in a magnetic field, of currents which interact with the field to produce Lorentz forces that oppose the flow. However, there are many liquids which are not sufficiently conducting to exploit this phenomenon; examples include the transparent liquids (such as succinonitrile-acetone) that are used as "model alloys" in fundamental solidification studies. There have been several investigations of the solidification of these liquids that have been carried out in orbiting laboratories to eliminate natural convection. The paper describes an investigation of an alternative approach whereby a magnetic field gradient is applied to the liquid. A magnetic body force then arises which is dependent on the susceptibility of the liquid and thereby on the temperature and or concentration. With the field gradient aligned vertically and of correct magnitude, the variation of gravitational body force due to temperature/concentration dependent density can be counterbalanced by a variation in magnetic body force. Experiments have been carried out in a super-conducting magnet at Marshall Space Flight Center to measure velocities in an aqueous manganese chloride solution. The solution was contained in a chamber with temperature controlled end walls and glass side walls. Velocities were measured by particle image velocimetry. Starting from zero current

in the magnet (zero field gradient) flow driven by the temperature difference between the end walls was measured. At a critical current the flow was halted. At higher currents the normal convection was reversed. The experiments included ones where the solution was solidified and were accompanied by solution of the flow/transport equations using the software package FLUENT.
Author

Magnetic Fields; Free Convection; Liquids; Solidification; Temperature Gradients; Temperature Dependence; Conductors

26
METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20000068441 Lockheed Martin Michoud Space Systems, Huntsville, AL USA

B218 Weld Filler Wire Characterization for Al-Li Alloy 2195

Bjorkman, Gerry, Lockheed Martin Michoud Space Systems, USA; Russell, Carolyn, NASA Marshall Space Flight Center, USA; [2000]; 24p; In English; Aeromat 2000 Conference, 26-29 Jun. 2000, Seattle, WA, USA

Contract(s)/Grant(s): NAS8-36200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Marshall Space Flight Center, Lockheed Martin Space Systems- Michoud Operations, and McCook Metals have developed an aluminum-copper weld filler wire for fusion welding aluminum lithium alloy 2195. The aluminum-copper based weld filler wire has been identified as B218, a McCook Metals designation. B218 is the result of six years of weld filler wire development funded by NASA, Lockheed Martin, and McCook Metals. The filler wire chemistry was developed to produce enhanced 2195 weld and repair weld mechanical properties over the 4043 aluminum-silicon weld filler wire, which is currently used to weld 2195 on the Super Lightweight External Tank for the NASA Space Shuttle Program. An initial characterization was performed consisting of a repair weld evaluation using B218 and 4043 weld filler wires. The testing involved room temperature and cryogenic repair weld tensile testing along with fracture toughness testing. From the testing, B218 weld filler wire produce enhanced repair weld tensile strength, ductility, and fracture properties over 4043. B218 weld filler wire has proved to be a superior weld filler wire for welding aluminum lithium alloy 2195 over 4043.
Author

Aluminum Alloys; Fusion Welding; Welded Joints; Aluminum-Lithium Alloys; Copper; Weld Strength; Welding

20000068978 United Engineering Foundation, Inc., New York, NY USA

An Interdisciplinary Approach to the Science of Alloys in Metals, Minerals and Other Materials Systems*, 7 Jan. 1999 - 6 Mar. 2000*

Gonis, A.; Melke, A.; Rajan, K.; Turchi, P. E.; Sep. 15, 1999; 52p; In English; 2nd, 8-13 Aug. 1999, Davos, Switzerland
Contract(s)/Grant(s): N00014-99-1-0895

Report No.(s): AD-A368789; 99-BS; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This is a second Triennial Conference on the physical, chemical, and mechanical properties of materials, interpreted to mean simple and complex inorganic solids, i.e., metals, semiconductors, and mineral of technological and environmental significance.
DTIC

Alloys; Mechanical Properties; Chemical Properties

20000068979 Materials Research Society, Warrendale, PA USA

Fracture and Ductile vs. Brittle Behavior -- Theory, Modelling and Experiment *Final Report*

Pachavis, Robert H.; Jan. 1999; 329p; In English; Symposium proceedings volume 539.

Report No.(s): AD-A366927; DAAG55-98-1-0478; ARO-39143.1-MS-CF; Copyright; Avail: Defense Technical Information Center (DTIC)

This volume contains papers presented at the 1998 MRS Fall Meeting in Boston, Massachusetts, in Symposium M, entitled "Fracture and Ductile vs. Brittle Behavior -- Theory, Modelling and Experiment."
CASI

Ductility; Brittleness; Fracture Mechanics

20000069365 Swedish Water and Air Pollution Research Lab., Goeteborg, Sweden

New Metals and Metalloids in Society *Nya Metaller och Metalloider i Samhaellet*

Sternbeck, J.; Oestlund, P.; Jun. 1999; 154p; In Swedish

Report No.(s): PB2000-103186; IVL-B-1332; No Copyright; Avail: National Technical Information Service (NTIS)

Most existing metal and metalloids are used in the society, e.g. in electronics, alloys, surface coating, building materials, glass, catalysts and medicine. In the absence of 100% recycling, this use will lead to the accumulation of metals in society, and this poses a risk of metal emission to the ecosystems. Knowledge concerning the detailed use of metals, the amounts used and their occurrence in the waste stage is essential in order to minimize accumulation and emission. In Sweden, this has previously been investigated for, e.g. Cd, Pb, Zn, Hg, Cr and Ni. Over the recent years, it has become apparent that other metals than the above-mentioned are becoming increasingly common in products that are used in everyday life. However, both environmental effects and the flow in society are largely unknown for a large number of metals. The objectives of this project is to analyze and describe, for 18 metal or metalloids.

NTIS

Environment Effects; Metals; Surface Properties

20000069801 NASA Marshall Space Flight Center, Huntsville, AL USA

An Overview of the MSFC Electrostatic Levitation Facility

Rogers, J. R., NASA Marshall Space Flight Center, USA; Robinson, M. B., NASA Marshall Space Flight Center, USA; Hyers, R. W., NASA Marshall Space Flight Center, USA; Savage, L., NASA Marshall Space Flight Center, USA; Rathz, T., Alabama Univ., USA; [2000]; 1p; In English; Materials Science Conference, 8 Jun. 2000, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Electrostatic levitation (ESL) provides a means to study molten materials in a contamination-free environment, including no contact with a container. Many phenomena important to materials science can be studied in the ESL. Solidification of metals, alloys and undercooled materials represent an important topic for research in the ESL. Recent studies of metals and alloys during solidification in the ESL are reported. Measurements include time, temperature and transformation of metallic glass-forming alloys, solidification velocities, and microstructure. This multimedia report includes a video clip showing processing in the ESL, with descriptions of the different segments in the text.

Author

Electrostatics; Levitation; Solidification; Metals

20000070507 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Fiscal 1997 report on the R and D result of industrial science and technology. R and D on super metal (R and D on innovative raw metal materials)

Mar. 31, 1998; 82p; In Japanese; In English

Report No.(s): DE99-718345; ETDE/JP-99718345; No Copyright; Avail: Department of Energy Information Bridge

Study was made on the applicability of mechanical milling (MM) and mechanical alloying (MA) to Fe system alloys. Metastable austenitic stainless steels such as SUS316L and SUS304L form (alpha) phases by strain induced transformation due to MM, and are subjected to further plastic deformation. Nano-size fine structure was obtained through inverse transformation into austenite(gamma) by heat treatment or high-temperature sintering of MM powder. Fine microduplex structure of 620 nm in average crystal grain size was obtained for SUS316L. This material showed nearly 3.3 times higher 0.2% tensile proof stress, nearly 1.8 times higher tensile strength, and 35% higher elongation than conventional ingot steels. Solid solution powder of 12Cr-Mo-W ferritic steel was sintered by hot isostatic pressing (HIP) under low-temperature and ultrahigh-pressure conditions of 650 C and 588 MPa.

NTIS

Research and Development; Metals; Technologies

20000070558 Saint Petersburg State Univ., Research Inst. of Mathematics and Mechanics, Saint Petersburg, Russia

Simulation of Dislocation and Transformation Plasticity in Shape Memory Alloys *Final Report, Oct. 1997 - Dec. 1998*

Volkov, Alexander E.; Jul. 12, 1999; 41p; In English

Contract(s)/Grant(s): N68171-97-M-5779

Report No.(s): AD-A368646; R/D-8174-AN-01; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

A model of deformation of shape memory alloys has been developed. It takes into account deformation due to the phase transformation and plastic deformation, produced by an external stress or by inter-phase stresses (micro-plastic deformation at accommodation of martensite). Constitutive equations are formulated basing on the background general microstructural approach named structure-analytical theory of strength. Equations describing variation of martensite content, phase and plastic deformations are formulated on the micro-level with the account of the symmetry and kinetics of these processes, appearance of internal stresses. Macroscopic quantities are obtained by averaging. Two variants of the model have been developed for alloys of Ti-Ni and Fe-Mn-Si types. Stress-strain and strain-temperature dependencies including strain accumulation at thermal cycling and

two-way shape memory effect have been described. An account of inter-grain stresses allowed to model some finer effects. A series of experiments has been carried out to study the influence of active plastic deformation on shape memory effects in TiNi alloys.
DTIC
Plastic Deformation; Shape Memory Alloys; Constitutive Equations; Deformation; Kinetics; Nickel Alloys; Plastic Properties; Simulation; Thermal Cycling Tests; Titanium Alloys

20000070842 Oregon Graduate Inst. of Science and Technology, Dept. of Materials Science and Engineering, Portland, OR USA
Finite Element Modeling of Residual Stresses in Electroslag Butt Welds *Final Report*
Atteridge, D.; Becker, M.; Khan, K.; Meekisho, L.; Tahmasebi, B.; Mar. 2000; 152p; In English
Report No.(s): PB2000-104064; FHWA/OR/RD-00/12; No Copyright; Avail: National Technical Information Service (NTIS)

   Shop fabricated electroslag (ES) welds used in bridge construction have had a history of low toughness in the fusion and heat affected zones. in addition, conventional inspection of ES weldments under shop fabrication fail to consistently detect and/or correctly size weld discontinuities. These problems have led to a Federal Highway Administration requirement for removal, re-enforcement, or re-evaluation of the integrity of ES weldments in existing Federal bridges. This study was initiated in partial response to this requirement by the Oregon Department of Transportation. The specific tasks of this study were: (1) to develop an understanding of ES weld-induced residual stresses for A36 steel with an emphasis on assessment of bridge-specific weld parameters and residual stress measurement; and (2) computational modeling of ES welding and the resultant stress distribution. The ES weldments assessed in this study were those used in the fabrication of the Oregon State I-205 West Linn Bridge. This research was performed by numerical modeling based on unknown welding parameters. Experimental assessment of fusion zone characteristics was used as input data for the computational modeling work. Selective etching techniques were used to reveal the solidification bands formed at the fusion line interface during ESW. Analysis of these solidification bands allowed determination of weld pool profiles formed during welding, which are a direct function of the welding parameters. The results indicated that the operation procedures for all of the assessed ES welds were nominally the same.
NTIS
Butt Joints; Finite Element Method; Mathematical Models; Residual Stress; Electroslag Welding

20000070865 NASA Marshall Space Flight Center, Huntsville, AL USA
Characterizing the Use of Ultrasonic Energy in Promoting Uniform Composite Growth in Immiscible Alloys
Grugel, Richard N., NASA Marshall Space Flight Center, USA; Fedoseyev, A. I., Alabama Univ., USA; [2000]; 1p; In English; Scientific Computing and Mathematical Modeling, 27 May 2000, Milwaukee, WI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

   The results of experimental investigation and mathematical modeling for immiscible alloys subjected to ultrasonic influence are presented. It is known that in inoculated light alloy melts, ultrasonic treatment creates a new type of cast structure with extremely fine grains of uniform composition. This effect is produced across a wide range of freezing rates and technologies. However, it has not been demonstrated that the process can be successfully applied during controlled directional solidification processing. In this work we present the results from a set of directional solidification experiments and suggest describing the droplet size versus ultrasonic frequency and amplitude using an energy approach, followed with a more detailed analysis through numerical modeling of the ultrasonic field.
Author
Light Alloys; Mathematical Models; Data Acquisition; Technology Assessment; Solubility

20000072487 NASA Marshall Space Flight Center, Huntsville, AL USA
Solid-Liquid Interface Characterization Hardware
Peters, Palmer N., NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

   The objective is to develop enabling technology to characterize the solid-liquid interface during directional solidification to unprecedented levels with real-time measurement hardware. Existing x-ray imaging hardware is combined with compact Seebeck furnaces and thermal profiling hardware, under development, to accomplish the measurements. Furnace thermal profiles are continuously measured in addition to the sample characteristics.
Derived from text
Hardware; Liquid-Solid Interfaces; Characterization; X Ray Imagery

20000072883 NASA Marshall Space Flight Center, Huntsville, AL USA
Novel Directional Solidification of Hypermonotectic Alloys
Grugel, Richard N., NASA Marshall Space Flight Center, USA; Fedoseyev, A. I., Alabama Univ., USA; [2000]; 1p; In English;
Materials Science Conference, 6 Jun. 2000, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

There are many metal alloy systems that separate into two different liquids upon cooling from a higher temperature. Uniform microstructural development during solidification of these immiscible liquids on Earth is hampered by inherent density differences between the phases. Microgravity processing minimizes settling but segregation still occurs due to gravity independent wetting and coalescence phenomena. Experiments with the transparent organic, metal analogue, succinonitrile-glycerol system were conducted in conjunction with applied ultrasonic energy. The processing parameters associated with this technique have been evaluated in view of optimizing dispersion uniformity. Characterization of the experimental results in terms of an initial modeling effort will also be presented.
Author
Directional Solidification (Crystals); Monotectic Alloys; Microstructure

20000073318 Virginia Polytechnic Inst. and State Univ., Center for Intelligent Material Systems and Structures, Blacksburg, VA
USA
Shape Memory Actuators for Tab-Assisted Control Surfaces *Final Report, 1 Jun. 1999-29 Feb. 2000*
Inman, Daniel J.; May 08, 2000; 11p; In English
Contract(s)/Grant(s): N00014-99-1-0822
Report No.(s): AD-A377471; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Actuation equations for a tab control system have been derived based on one-dimensional shape memory behavior. This actuation model accounts for the active tendon having to pull against the relaxing tendon in a two-tendon actuator. That is, the passive tendon will provide a negative moment, subtracting from the total moment available for moving the tab. In addition, studies on the heat convection of SMA in water and moving water have been performed in an attempt to determine the available control moment in moving water and to predict the amount of energy needed. These results identify the research issues that must be overcome in making a recommendation regarding the feasibility of using SMA in a submarine for actuation. The result is that use of SMA is feasible, but the exact performance results are not predictable with the current state-of-the-art in SMA modeling. Furthermore, predictive design models specific to applications in moving water are needed to understand the issues of: (1) exact moment prediction, (2) exact heat signature, and (3) control predictions for maneuvering.
DTIC
Control Surfaces; Shape Memory Alloys; Actuators; Convective Heat Transfer; Maneuvers

20000074075 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Fabrication of an Aluminum Based Hot Electron Mixer for Terahertz Applications
Echternach, P. M., Jet Propulsion Lab., California Inst. of Tech., USA; LeDuc, H. G., Jet Propulsion Lab., California Inst. of Tech.,
USA; Skalare, A., Jet Propulsion Lab., California Inst. of Tech., USA; McGrath, W. R., Jet Propulsion Lab., California Inst. of
Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Aluminum based diffusion cooled hot electron bolometers (HEB) mixers, predicted to have better noise, bandwidth and to require less LO power than Nb based diffusion cooled HEBs, have been fabricated. Preliminary DC tests were performed. The bolometer elements consisted of short (0.1 to 0.3 micron), narrow (0.08 to 0. 15 micron) and thin (11 nm) aluminum wires connected to large contact pads consisting of a novel trilayer Al/Ti/Au. The patterns were defined by electron beam lithography and the metal deposition involved a double angle process, the Aluminum wires being deposited straight on and the pads being deposited at a 45 degree angle without breaking vacuum. The Al/Ti/Au trilayer was developed to provide a way of making contact between the aluminum wire and the gold antenna. The Titanium layer acts as a diffusion barrier to avoid damage of the Aluminum contact and bolometer wire and to lower the transition temperature of the pads to below that of the bolometer wire. The Au layer avoids the formation of an oxide on the Ti layer and provides good electrical contact to the IF/antenna structure. The resistance of the bolometers as a function of temperature was measured. It is clear that below the transition temperature of the wire (1.8K) but above the transition temperature of the contact pads (0.6K), the proximity effect drives most of the bolometer wire normal, causing a very broad transition. This effect should not affect the performance of the bolometers since they will be operated at a temperature below the TC of the pads. This is evident from the IV characteristics measured at 0.3K. RF characterization tests will begin shortly.
Author
Fabrication; Aluminum; Titanium; Gold; Hot Electrons; Bolometers; Mixers

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.

20000068521 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Butyl Rubber: Compound Development and Characterization *Final Report, Oct. 1996-Sep. 1998*
Sloan, James M.; Apr. 2000; 38p; In English
Report No.(s): AD-A376816; ARL-TR-2224; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    This report is intended to summarize the research efforts at the U.S. Army Research Laboratory (ARL) and at the Materials Technology Laboratory, currently the Weapons and Materials Research Directorate (WMRD), to develop the standard butyl rubber compound. The strategy of this work was to compound- and compression-mold high-quality, uniform butyl rubber experimental sheets and to evaluate their cure properties, mechanical properties, and-most importantly-their protective barrier properties, as determined by the MIL-282 method 204 droplet breakthrough test performed at the Edgewood Research, Development, and Engineering Center, Product Assurance Directorate (ERDEC-PAD). The test was performed at ERDEC with chemical agents in a qualified laboratory environment and with chemical agent simulants at ARL in Watertown, MA.
DTIC
Rubber; Butenes; Characterization

20000068528 NASA Langley Research Center, Hampton, VA USA
Intensity Biased PSP Measurement
Subramanian, Chelakara S., Florida Inst. of Tech., USA; Amer, Tahani R., NASA Langley Research Center, USA; Oglesby, Donald M., NASA Langley Research Center, USA; Burkett, Cecil G., Jr., NASA Langley Research Center, USA; [2000]; 9p; In English; 21st; Aerodynamic Measurement Technology and Ground Testing, 19-22 Jun. 2000, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 2000-2526; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche
    The current pressure sensitive paint (PSP) technique assumes a linear relationship (Stern-Volmer Equation) between intensity ratio (I(sub o)/I) and pressure ratio (P/P(sub o)) over a wide range of pressures (vacuum to ambient or higher). Although this may be valid for some PSPs, in most PSPs the relationship is nonlinear, particularly at low pressures (less than 0.2 psia when the oxygen level is low). This non-linearity can be attributed to variations in the oxygen quenching (de-activation) rates (which otherwise is assumed constant) at these pressures. Other studies suggest that some paints also have non-linear calibrations at high pressures; because of heterogeneous (non-uniform) oxygen diffusion and quenching. Moreover, pressure sensitive paints require correction for the output intensity due to light intensity variation, paint coating variation, model dynamics, wind-off reference pressure variation, and temperature sensitivity. Therefore to minimize the measurement uncertainties due to these causes, an insitu intensity correction method was developed. A non-oxygen quenched paint (which provides a constant intensity at all pressures, called nonpressure sensitive paint, NPSP) was used for the reference intensity (I(sub NPSP) with respect to which all the PSP intensities (I) were measured. The results of this study show that in order to fully reap the benefits of this technique, a totally oxygen impermeable NPSP must be available.
Author
Pressure Ratio; Paints; High Pressure; Temperature Effects; Luminous Intensity

20000069649 Michigan Univ., Ann Arbor, MI USA
AASERT Student Research on Non-Oxide Structural Ceramics - Alloy Design for Improved Sinterability and Mechanical Performance *Final Report, 1 Jul. 1995-30 Sep. 1998*
Chen, I–Wei; Dec. 31, 1998; 6p; In English
Contract(s)/Grant(s): F49620-95-1-0460; AF Proj. 3848
Report No.(s): AD-A377615; AFRL-SR-BL-TR-00-0184; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
    The objective of this research is to design micro structures in non-oxide ceramics to improve their mechanical performance and sinter ability. Silicon nitride and silicon carbide with similarly controlled micro structures and residual stress distribution have been investigated. The grant was initiated in 1996. The AASERT student supported by the grant, Anatoly Rosenflanz, discovered an in-situ toughened a'-SiAlON and a patent was filed. This research has been publicly reported since 1997 and has received broad attention. We have also explored the compositional range over which in-situ toughened a'-SiAlON can be obtained. This essentially encompasses the entire single a'-phase region at the higher temperature. We have made a systematic effort to obtain kinetic data on phase transformation at different compositions since this knowledge is critically important for the precise control of nucle-

ation and growth which dictate the microstructure. We have shown that the mechanical strength of a'-SiAlON can exceed 1 GPa and the strength retention is good at least up to 1350 degrees . We have lastly reported phase relations in melilite-containing silicon nitride and their properties, as well as a series of super plastic silicon nitride.
DTIC
Ceramics; Sialon; Silicon Carbides; Silicon Nitrides; Mechanical Properties

20000069784 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
National Emission Standards for Hazardous Air Pollutants (NESHAP): Polymers and Resins (Groups 1 and 4): Summary of Public Comments and Responses on Proposed Amendments
Dec. 1999; 52p; In English
Report No.(s): PB2000-104061; EPA/453/P-99/001; No Copyright; Avail: National Technical Information Service (NTIS)
     This document contains a summary of public comments received on amendments to NESHAP for Polymer and Resin (Groups I and IV) (40 CFR 63, subparts U and JJJ), which were proposed on March 9, 1999 (64 FR 11560). This document also provides the EPA's response to each comment, and outlines the changes made to these regulations in response to public comments.
NTIS
Pollution Control; Regulations; Emission

20000069849 Army Construction Engineering Research Lab., Champaign, IL USA
Sonolysis of Nitrocellulose Fines *Final Report*
Cropek, Donald M.; Dankowski, Brian; May 2000; 40p; In English
Contract(s)/Grant(s): Proj-BT25
Report No.(s): AD-A377921; ERDC/CERL,TR-00-14; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
     Nitrocellulose (NC) fines are the small polymer fibers of NC that are not separable from the NC production stream by settling or centrifugation. Wastewater containing NC fines at a concentration of 150 to 400 parts per million is one of the largest volume waste streams produced by the Army. Current methods of control and disposal depend upon the lack of strict regulations regarding the environmental release of NC fines. Possible changes in the interpretation of state regulations would create immediate disposal problems. Numerous research efforts have investigated NC treatment methods from the novel to the mundane. This report provides data on the effects of high intensity ultrasound on NC degradation in water. The results indicate that NC is resistant to depolymerization and denitration by sonolytic means.
DTIC
Ultrasonics; Waste Disposal; Fines; Cellulose Nitrate; Degradation

20000069866 METSS Corp., Columbus, OH USA
Development and Optimization of Powders for Large Area Powder Coatings *Final Report, 1 Jun. 1996-30 Apr. 1997*
Heater, Kenneth J., METSS Corp., USA; May 1997; 61p; In English
Contract(s)/Grant(s): F33615-94-C-5803; AF Proj. 2422
Report No.(s): AD-A377644; G-96-003-FR; AFRL-ML-WP-TR-2000-4049; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy
     Technologies with the potential to produce mono-disperse powders for High Velocity Thermal Spray (HVTS) application and pigmented polymer beads for advanced aircraft coatings formulations were evaluated under this program. Conventional spray atomization techniques, including supercritical fluid spray atomization, and REES processing were determined to be ineffectual in meeting the objectives. However, experimental results of supercritical Gas Anti-Solvent (GAS) processing and inkjet production methods demonstrated the potential of each of these technologies to produce the desired products. Additional formulation development and process optimization work will have to be performed before sufficient quantities (10 lbs) of materials can be produced for HVTS testing and evaluation.
DTIC
Powder (Particles); Sprayed Coatings; Aircraft Maintenance; Production Engineering

20000070409 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Flexible Low-Mass Devices and Mechanisms Actuated by Electroactive Polymers
Bar–Cohen, Y, Jet Propulsion Lab., California Inst. of Tech., USA; Leary, S., Jet Propulsion Lab., California Inst. of Tech., USA; Shahinpoor, M., New Mexico Univ., USA; Harrison, J. O., NASA Langley Research Center, USA; Smith, J., NASA Langley Research Center, USA; [1999]; 7p; In English; 6th; Smart Structures and Materials, 1-5 Mar. 1999, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA

Report No.(s): Paper 3669-38; Copyright; Avail: Issuing Activity

Miniature, lightweight, miser actuators that operate similar to biological muscles can be used to develop robotic devices with unmatched capabilities to impact many technology areas. Electroactive polymers (EAP) offer the potential to producing such actuators and their main attractive feature is their ability to induce relatively large bending or longitudinal strain. Generally, these materials produce a relatively low force and the applications that can be considered at the current state of the art are relatively limited. This reported study is concentrating on the development of effective EAPs and the resultant enabling mechanisms employing their unique characteristics. Several EAP driven mechanisms, which emulate human hand, were developed including a gripper, manipulator arm and surface wiper. The manipulator arm was made of a composite rod with an EAP actuator consisting of a scrolled rope that is activated longitudinally by an electrostatic field. A gripper was made to serve as an end effector and it consisted of multiple bending EAP fingers for grabbing and holding such objects as rocks. An EAP surface wiper was developed to operate like a human finger and to demonstrate the potential to remove dust from optical and IR windows as well as solar cells. These EAP driven devices are taking advantage of the large actuation displacement of these materials but there is need for a significantly greater actuation force capability.
Author
Actuators; End Effectors; Miniaturization; Robotics; Manipulators

20000070420 Army Cold Regions Research and Engineering Lab., Hanover, NH USA
Procedures for the Evaluation of Sheet Membrane Waterproofing
Korhonen, Charles J.; Buska, James S.; Cortez, Edel R.; Greatorex, Alan R.; Aug. 1999; 69p; In English
Report No.(s): AD-A368678; CRREL-SR-99-11; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Sheet membrane waterproofing has been used to protect bridge decks against water and deicing salts by transportation agencies in New England for more than two decades. Though such membranes have proven useful at extending the useful life of bridge decks, there are no convenient methods to evaluate one membrane against another. This report details the genesis of blisters, a major problem for membranes, and defines test procedures to evaluate sheet membranes based on their ability to adhere to concrete, accommodate strain, resist puncturing, and pass water vapor. The results of these tests allow an engineer to compare sheet membranes based on material properties but they, alone, cannot be used to predict how well a membrane will perform in practice. Because a laboratory environment does not reflect the complex combination of forces and deterioration mechanisms a membrane is exposed to in the field, a follow-on study of the installation/design process and long-term performance of membranes in actual bridges needs to be conducted. This report provides a needed step toward the ability to predict sheet membrane service life.
DTIC
Membranes; Waterproofing; Bridges (Landforms); Concretes

20000070443 Defence Science and Technology Organisation, Melbourne Australia
Energetic Polymers and Plasticisers for Explosive Formulations: A Review of Recent Advances
Provatas, Arthur, Defence Science and Technology Organisation, Australia; Apr. 2000; 48p; In English
Report No.(s): AD-A377866; DSTO-TR-0966; DODA-AR-011-428; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

In an effort to comply with Insensitive Munitions (IM) criteria, energetic binders comprising polymer and plasticiser(s) are finding use in cast-cured polymer bonded explosives and cast composite rocket propellants. Energetic binders can be considered as cross-linked polymers that provide a matrix to bind explosive ingredients together with a plasticiser. Once cured, the polymeric binder is a tough elastomeric rubber capable of absorbing and dissipating energy from hazardous stimuli, lending itself well to IM applications. This general document outlines the most promising energetic polymers and plasticisers being considered today. Attention is focussed on several energetic polymers including glycidyl azide polymer, GAP, poly(3-nitratomethyl-3-methyloxetane), polyNIMMO and poly(glycidyl nitrate), polyGLYN, although several other energetic polymers will also be reviewed. Energetic plasticisers including oligomers (low molecular weight) of the polymers mentioned above, as well as a variety of nitrate esters, nitroaromatics and azido plasticisers, will also be reviewed. Finally, the review will recommend binder systems for DSTO's future energetic binder programs.
DTIC
Propellant Binders; Plasticizers; Crosslinking; Explosives; Glycidyl Azide Polymer

20000070506 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Research report of FY 1997 on the industrial science and technology development. Technology development of super-metal (technology development of nano-amorphous structural control materials)

Mar. 31, 1998; 233p; In Japanese; In English

Report No.(s): DE99-718344; ETDE/JP-99718344; No Copyright; Avail: Department of Energy Information Bridge

Research and development of the innovative metals have been conducted, by which the weight reduction of members can be done by drastically improving the strength compared with conventional metals. For the high-rate cluster deposition and super plastic forming technologies, research and development of aluminum-based light-weight materials have been conducted, which provides excellent strength, toughness, and super plastic formability at room temperature. For the high-density energy utilization and control technology (amorphous-A), super-metals have been investigated as high dew point and corrosion resistance materials used for waste incinerators operated under the very severe conditions. These are expected to be applied to the apparatuses and equipment due to their excellent properties. For the controlled cooling technology (amorphous-B), super-metals with excellent soft magnetic characteristics and degree of shape freedom have been investigated for high performance and high efficiency devices including electric/electronic/communication devices, power transmission devices, and various industrial devices and parts. These are expected to contribute to the creation of new markets and the improvement of international competitive force.
NTIS

Metals; Research and Development; Amorphous Materials

20000070508 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Research report of FY 1997 on the technology trend survey meetings for highly creative and functional material creation technology

Feb. 28, 1998; 35p; In Japanese; In English

Report No.(s): DE99-718348; ETDE/JP-99718348; No Copyright; Avail: Department of Energy Information Bridge

Survey and research have been conducted to plan and investigate the direction of creative material development. The survey and research were carried out through discussions in the symposium and meetings. For the symposium, were presented the activities of Asahi Research Center for reducing the environmental loads, environmentally acceptable industries and materials, needs and research/development trends related to ceramics including artificial lattice, processes and composites, no needs is good needs, needs and future research/development in chemical companies, and the display material development. For the results of national institutes of the Agency of Industrial Science and Technology, 17 papers were presented which include the neuro-computer for distinguishing plastic wastes, development and assessment of biodegradable plastics, recycling of high molecular wastes, super plastic silicon nitride with an ultra-long life through the formation of orientated texture, reaction hot-press of carbonized chaff by adding metal oxides, etc.
NTIS

Trends; Research and Development; Technologies; Composite Materials

20000070513 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Fiscal 1997 report on the results of the cooperative research project under consignment from NEDO on technology for simply setting-up of the molding conditions of engineering plastics

Mar. 31, 1998; 258p; In Japanese; In English

Report No.(s): DE99-718357; ETDE/JP-99718357; No Copyright; Avail: Department of Energy Information Bridge

A cooperative research project was carried out between Japan and Thailand with the aim of developing a system which can simply set up molding conditions using as elements the technology on mold design and injection molding in plastic parts production and the experiment/evaluation technology for making sure of the quality of molded products. In fiscal 1997, based on the basic plan worked out in the previous fiscal year, molding equipment, auxiliary equipment, mold, experimental equipment, injection molding CEA system, etc. were installed at Thailand's BSID (Bureau of Supporting Industries Development). Supported by equipment manufacturers, the technical guidance was given for operation/maintenance/control of all equipment. At the same time, researchers were sent from Japan, and the joint research was started. Japan received three researchers from BSID for training of molding technology, injection molding CEA program use technology, and experimental evaluation technology. The engineering plastics used for study are polyacetal, polyamide and polycarbonate.
NTIS

Injection Molding; Polyamide Resins; Technology Transfer; Computer Aided Manufacturing

20000070680 Thiokol Propulsion, Brigham City, UT USA

Separation and Characterization of Phenolic Resin by Using HPLC and GPC Combined with UV, RI, MS and Light Scattering Detection

Li, Ping, Thiokol Propulsion, USA; Coleman, D. W., Thiokol Propulsion, USA; Spaulding, K. M., Thiokol Propulsion, USA; McClennen, W. H., Thiokol Propulsion, USA; Stafford, P. R., Thiokol Propulsion, USA; Fife, D. J., Thiokol Propulsion, USA;

[2000]; 33p; In English; 24th; 24th International Symposium on High Performance Liquid Phase Separations, 24-29 Jun. 2000, Seattle, WA, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS8-97238; Copyright; Avail: Issuing Activity

Phenolic resins are among the most widely used thermosetting resins and are produced by polycondensation of phenol with formaldehyde in the presence of an acid or base catalyst. Varying catalysts, mole ratios of the reactants and reaction temperatures can form different types of resins and lead to different chemical structures and properties. The phenolic resins produced are mixtures of very reactive compounds. These reactive compounds in a resin product can range from low molecular weight phenol-formaldehyde monomers, dimers and trimers to high molecular weight polymers. Phenolic resins are primarily polar products yet the polarity of these products can vary depending on the ratio of phenol-to-formaldehyde during production. The solubility of the resin product is strongly related to both the polarities of the different compounds and their molecular weight distribution. In this work, reverse phase HPLC and GPC test methods for separation and characterization of phenol-formaldehyde resins were studied and developed. Some of the difficulties in the chromatographic analysis of phenolic resin were discussed and several procedures developed to overcome these problems were explored. Reverse phase HPLC is considered as one of the most efficient separation techniques for polar compounds and has been used to fingerprint the phenolic monomers, dimers, and some of the oligomers. The molecular weight and aromatic substitution of these phenolic compounds were determined using an on-line photo-diode array detector (PAD) and an ion trap mass spectrometer. In order to overcome the incompatibility of solubility and the elution property of phenolic polymers by HPLC, a GPC procedure was applied to analyze all of the THF soluble phenolics. The molecular weight distribution of the phenolics was determined by both conventional and laser light scattering calibration methods. The structural information of the phenolic polymers is discussed. When combined with both UV and RI detection in the GPC procedure, the weight concentration of phenolic resin and the molar concentration of the phenol unit in the phenolic oligomers or polymers can be determined. An attempt to evaluate the reactivity and cross-link density of a phenolic resin product based on this method is also discussed.
Author
Separation; Characterization; Phenolic Resins; Chemical Composition; Formaldehyde; High Polymers; Low Molecular Weights; Phenol Formaldehyde

20000070740 Air Force Research Lab., Sensors Directorate, Wright-Patterson AFB, OH USA
Investigation of Polymer Optical Waveguide Devices *Final Report, 5 May 1995-10 Jan 1999*
Grote, James G.; Brandelik, Joseph E.; Nov. 1999; 122p; In English; This in-house effort was funded in part by DARPA.
Contract(s)/Grant(s): Proj-ARPE
Report No.(s): AD-A377639; AFRL-SN-WP-TR-1999-1131; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report is an initial investigation into polymer waveguides. The CAD program BEAMPROP is utilized for modeling of waveguides. Passive multi-mode and single-mode waveguides are considered. For modeling nonlinear optical polymers, in addition to the BEAMPROPAGATION (BEAMPROP) method, the effective index method and the MARCATILI model are developed. It is shown that a conducting cladding layer for the rectangular waveguides could significantly improve the operation performance of nonlinear optical, poled polymer waveguides.
DTIC
Optical Waveguides; Beam Waveguides; Rectangular Waveguides

20000072427 California Univ., San Diego, Dept. of Applied Mechanics and Engineering Sciences, La Jolla, CA USA
Dynamic Response, Residual Strength, and High Strain-Rate Failure Modes of Rock and Concrete *Final Report, 1 Aug. 1996-31 Oct. 1999*
Nemat–Nasser, Sia; Apr. 15, 2000; 41p; In English
Contract(s)/Grant(s): F49620-96-1-0393
Report No.(s): AD-A377673; AFRL-SR-BL-TR-00-0189; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

At UCSD, we have initiated a fundamental research program in order to understand and quantify the dynamic response and failure modes of rocks and concrete, using a coordinated effort which involves material characterization, high-strain-rate experiments, and physically-based analytical-computational modeling. The work includes the following major tasks: I. Microstructural Characterization (1.1: Ultrasonic Measurements; 1.2: Microscopy; 1.3: Image Processing; 1.4: Statistical Measures), II. Mechanical Tests (11.1: Quasi-static Experiments; 11.2: Hopkinson Bar Experiments; 11.3: Gas Gun Experiments), 111. Model Experiments, IV. Physically-based Modeling, and V. Verification of Model Predictions. The research includes a set of carefully designed recovery experiments using UCSD's 2.5- and 6-inch gas guns and the 1.5-and 3-inch Hopkinson bars; the mechanisms and nature of shock-induced damage in the material are being studied. The strain rate, stress amplitude, and the total input energy are controlled in these tests. Both jacketed and unjacketed samples are used. Through the use of ultrasonic measurements, the degrada-

tion in the sample stiffness will be measured nondestructively. These measurements will then be correlated with microscopic observations of the specimens, using optical microscopy and SEM. Based on the knowledge gained through the above experimental observations, a set of new experiments is planned to study the residual strength and dynamic response of shocked materials. Once the dominant microstructural features are identified, model experiments will be designed to directly examine the damage evolution process.

DTIC

Dynamic Response; Residual Strength; Strain Rate; Failure Modes; Rocks; Concretes

20000072428 Michigan Univ., Ceramic Composites Research Lab., Ann Arbor, MI USA

Influence of Loading Frequency on the Elevated Temperature Fatigue Behavior of Fiber-Reinforced Ceramic Composites
Final Report, 1 Oct. 1997-30 Sep. 1999

Holmes, John W.; Jan. 15, 1999; 33p; In English

Contract(s)/Grant(s): F49620-98-1-0018; AF Proj. 2306

Report No.(s): AD-A377671; AFRL-SR-BL-TR-00-0187; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Cyclic tension-tension experiments were conducted on a ceramic matrix composite of continuous Nicalon SiC-fibers in a calcium-aluminosilicate matrix. Two different stress ratios (R = sigma(min)/sigma(max)) were studied (R = 0.5 and R = 0.05) at a loading frequency of 200 Hz. Specimens tested at R = 0.05 were found to have a shorter fatigue life than specimens tested at R = 0.5. The fatigue limit (defined as run-out at 10(exp 8) cycles) increased from 212 MPa for R = 0.05 to 240 MPa for R = 0.5. Microstructural investigations revealed an internal zone with no fiber pull-out at the fracture surface, suggesting that the fatigue failures occur due to internal embrittlement. The loading condition with smallest stress range (i.e., the largest stress ratio) has the lowest amount of interfacial sliding (and thus the lowest frictional energy dissipation). It is therefore plausible that the fatigue damage is related to the amount of interfacial sliding.

DTIC

High Temperature; Thermal Fatigue; Fatigue Life; Fiber Composites; Ceramic Matrix Composites; Fiber Pullout

20000072492 Massachusetts Inst. of Tech., Dept. of Mechanical Engineering, Cambridge, MA USA

The Considere Condition and Rapid Stretching of Linear and Branched Polymer Melts

McKinley, Gareth H., Massachusetts Inst. of Tech., USA; Hassager, Ole, Technical Univ. of Denmark, Denmark; Journal of Rheology; September/October 1999; ISSN 0148-6055; Volume 43, No. 5, pp. 1195-1212; In English

Contract(s)/Grant(s): NCC3-610; NAG3-1793; RTOP 101-33-00; Copyright; Avail: Issuing Activity

We analyze the onset of "necking" and subsequent filament failure during the transient uniaxial elongation of viscoelastic fluid samples in extensional rheometers. In the limit of rapid elongation (such that no molecular relaxation occurs), the external work applied is all stored elastically and the Considere criterion originally developed in solid mechanics can be used to quantitatively predict the critical Hencky strain to failure. by comparing the predictions of the Doi-Edwards model for linear homopolymer melts with those of the "Pom-Pom" model for prototypical branched melts we show that the critical strain to failure in rapid elongation of a rubbery material is intimately linked to the molecular topology of the chain, especially the degree of chain branching. The onset of necking instability is monotonically shifted to larger Hencky strains as the number of branches is increased. Numerical computations at finite Deborah numbers also show that there is an optimal range of deformation rates over which homogeneous extensions can be maintained to large strain. We also consider other rapid homogeneous stretching deformations, such as biaxial and planar stretching, and show that the degree of stabilization afforded by inclusion of material with long-chain branching is a sensitive function of the imposed mode of deformation.

Author

Viscoelasticity; Linearity; Mathematical Models; Melting; Stretching; Branching (Physics); Polymers

20000073283 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Degree of Cure, Heat of Reaction, and Viscosity of 8552 and 977-3 HM Epoxy Resin

Ng, S. J.; Boswell, R.; Claus, S. J.; Arnold, F.; Vizzini, A.; Mar. 10, 2000; 21p; In English

Report No.(s): AD-A377439; NAWCADPAX/TR-2000/16; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The heat of reaction, degree of cure, and viscosity of Hexcel 8552 and Cytec Fiberite 977-3 HM neat resins were measured using a modulated differential scanning calorimeter and a rheometric digital analyzer. Expressions were developed using isothermal tests for correlating the rate of degree of cure and the viscosity with the degree of cure using a Lee, Loos, and Springer approach. The models were exercised to predict the kinetic behavior of the resins using respective manufacturer cure cycles. Data were collected and good correlation was found with the model. In addition, kinetic behaviors of these systems were compared to Hercules 3501-6 data. A second study was also performed to investigate cure models developed based on neat and prepreg forms

of the resin. Vastly different viscosity behaviors were found indicating further physical insights are necessary to account for fiber/ resin content and material properties difference.

DTIC

Epoxy Resins; Fiber Composites; Curing; Thermosetting Resins; Heat Measurement

20000073396 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Development of high-Tc superconductor material by pyrophoric synthetic method

Shin, H. S.; Park, J. S.; Yang, S. W.; Kim, Y. S.; Kim, Y. S.; Jul. 31, 1997; 51p; In Korean; In English

Report No.(s): DE99-727843; KAERI-CM-132/96; No Copyright; Avail: Department of Energy Information Bridge

The YBCO, and BSCCO powder were prepared by pyrophoric synthetic method. The phase formation and reaction kinetics of superconductor manufactured with powder prepared in various pHs of pyrophoric solution have been studied through the experiments at various heat treatment temperature and time. Inductively coupled plasma spectroscopy(ICP) and scanning electron microscopy(SEM) measurements were performed to examine the composition and morphology property of the sample. X-ray diffraction analysis(XRD) was done to determine phase formation and conversion ratio of YBCO systems. The 123 powder prepared at pH 7((+-)0.3) yield the best result in terms of purity, homogeneity, and reactivity. The activation energies((delta)E(sub a)) of 123 phase formation were found to be 200.0 kJ/mol and 230.0 kJ/mol of solid state reaction method and pyrophoric synthesis method, respectively.

Author

BSCCO Superconductors; Composition (Property); YBCO Superconductors; Pyrophoric Materials

20000074092 NASA Glenn Research Center, Cleveland, OH USA

Development and Testing of Cooled CMCs for High Thermal Flux Applications

Patterson , Mark, Ceramic Composites, Inc., USA; Jaskowiak, Martha, NASA Glenn Research Center, USA; Elam, Sandy, NASA Marshall Space Flight Center, USA; Effinger, Mike, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Space 2000 Technology Conference and Exposition, 19-21 Sep. 2000, Long Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Ceramic Matrix Composites (CMCS) offer the potential for significant weight savings and improved performance for a range of propulsion components utilizing refractory materials. This paper describes the fabrication and testing of functionally graded CMCs produced via a low cost process that represents an order of magnitude cost savings over conventionally fabricated CMCS. Test cylinders were fabricated, characterized and evaluated during exposure to high thermal fluxes of up to 10MW/meters squared at the Laser Hardened Materials Evaluation Laboratory (LHMEL). The bulk density of the CMC tubes was approximately 2.2 grams per cubic centimeters. The performance of cryogenically cooled CMCs was compared with uncooled CMCs against similar thermal loads, and fundamental property data collected for this relatively new breed of CMC. Finally, test thrust cells were fabricated from the functionally graded composite and tested using liquid H2 and O2 propellants at NASA Glen.

Author

Ceramic Matrix Composites; Cooling; Thermal Analysis; Fabrication; Heat Flux

20000074109 NASA Marshall Space Flight Center, Huntsville, AL USA

NASA Out-of-Autoclave Process Technology Development

Johnston, Norman, J., NASA Langley Research Center, USA; Clinton, R. G., Jr., NASA Marshall Space Flight Center, USA; McMahon, William M., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; United Eng Foundation Processing of Fibers and Comp, 21-25 May 2000, Pascoli, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

Polymer matrix composites (PMCS) will play a significant role in the construction of large reusable launch vehicles (RLVs), mankind's future major access to low earth orbit and the international space station. PMCs are lightweight and offer attractive economies of scale and automated fabrication methodology. Fabrication of large RLV structures will require non-autoclave methods which have yet to be matured including (1) thermoplastic forming: heated head robotic tape placement, sheet extrusion, pultrusion, molding and forming; (2) electron beam curing: bulk and ply-by-ply automated placement; (3) RTM and VARTM. Research sponsored by NASA in industrial and NASA laboratories on automated placement techniques involving the first 2 categories will be presented.

Author

Polymer Matrix Composites; Reusable Launch Vehicles; Autoclaves; Low Earth Orbits; International Space Station

Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.

20000069795 Energy Information Administration, Office of Energy Markets and End Use, Washington, DC USA
International Energy Annual, 1998
Jan. 2000; 238p; In English
Report No.(s): PB2000-105902; DOE/EIA-0219(98); No Copyright; Avail: CASI; A03, Microfiche; A11, Hardcopy

The International Energy Annual presents an overview of key international energy trends for production, consumption, imports, and exports of primary energy commodities in over 220 countries, dependencies, and areas of special sovereignty. Also included are population and gross domestic product data, as well as prices for crude oil and petroleum products in selected countries. Renewable energy reported in the International Energy Annual includes hydroelectric power and biomass, geothermal, solar, and wind electric power. Also included are biomass, geothermal, and solar energy produced in the United States and not used for electricity generation.
NTIS
Energy Consumption; Energy Technology; Hydroelectricity; International Trade

20000069806 Air Force Research Lab., Wright-Patterson AFB, OH USA
The Development of JP-8 as a Replacement Fuel for JP-TS Jet Fuel
Obringer, C., Air Force Research Lab., USA; Ervin, J. S., Dayton Univ. Research Inst., USA; Zabarnick, S., Dayton Univ. Research Inst., USA; Davis, D., Dayton Univ. Research Inst., USA; Binns, E., Dayton Univ. Research Inst., USA; Dieterle, G., Dayton Univ. Research Inst., USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 37-46; In English; See also 20000069802
Contract(s)/Grant(s): F33615-97-C-2719; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

JPTS is a specialty fuel that has excellent thermal-oxidative stability characteristics and a low freeze point temperature. Unfortunately, JPTS costs nearly five times as much as the more readily available JP-8 fuel. In addition, replacement of JPTS with JP-8 has important logistical advantages. Thus, it would be advantageous to have a JP-8 fuel that has thermal-oxidative and low-temperature characteristics that are similar to those of JPTS. The JP-8+100 additive package that has been developed previously provides JP-8 fuels with very low surface deposition characteristics. However, enhancement of the low-temperature behavior of JP-8 has not been addressed. An effort has recently been undertaken to study the feasibility of developing low-temperature additives for JP-8+1 00 fuel. One objective was to experimentally determine if a class of additives commonly used in diesel fuels (cold flow enhancers) could effectively be used in kerosene based fuels. The additives, developed by several additive manufacturers, were blended with a representative JP-8+100 fuel. The additives were evaluated in a low-temperature test facility that was designed to simulate severe conditions (-54 to -57 C) existing within an aircraft fuel wing tank. Both the amount of solidified fuel remaining in the tank after the flowing fuel had been drained (hold-up) and the reduction in fuel flow rate from that at 21 C were measured. We observed significant enhancement of the cold flow characteristics of the fuel by some of the tested additives. These results strongly suggest that an additive can be used to enhance the low-temperature properties of JP-8+1 00 such that it behaves more like JPTS.
Author
Jet Engine Fuels; JP-8 Jet Fuel; Replacing; Additives; Low Temperature

20000069808 Army Tank-Automative Research and Development Command, Picatinny Arsenal, NJ USA
Modeling and Simulation of Degradation of Comp C4
Bixon, Eric R., Army Tank-Automative Research and Development Command, USA; JANNAF 24th Airbreathing Propulsion Subcommittee and 36th Combustion Subcommittee Joint Meeting; October 1999; Volume 1, pp. 65-72; In English; See also 20000069802; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Accelerated aging experiments were conducted on M112 demolition blocks at 5 temperatures including 140 F, 165 F, 185 F, 210 F and 255 F. The mechanical properties were evaluated using a penetrometer on samples aged for varying amounts of time at the above temperatures. From the penetrometer results, the failure mechanisms were deduced. In addition to the penetrometer results, attribute data (Good or Bad) was collected for each of the blocks. The data was based on the "feel" of the blocks as evaluated by a team including two demolition experts from the U.S. Army and a TACOM/ARDEC engineer. The attribute data was

used to fit a lognormal failure distribution to the data at each temperature. The median lifetime was then correlated with temperature using the Arrhenius equation. The results were used to predict the service life at 55 F.
Author
Aging (Materials); Mechanical Properties; Mathematical Models; Computerized Simulation; Degradation; Accelerated Life Tests

20000069841 Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA USA
Estimated Oil and Gas Reserves, Gulf of Mexico, December 31, 1997 *Annual Report*
Crawford, T. G.; Bascle, B. J.; Kinler, C. J.; Premdergast, M. T.; Ross, K. M.; Jan. 2000; 42p; In English
Report No.(s): PB2000-103314; OCS/MMS-2000/006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    This report presents original proved reserves, cumulative production, remaining proved reserves, and unproved reserves as of December 31, 1997, for the Gulf of Mexico (GOM).
NTIS
Oil Fields; Reserves; Gulf of Mexico

20000070417 Dean Applied Technology Co., Huntsville, AL USA
Design and Testing of Demonstration Unit for Maintaining Zero Cryogenic Propellant Boiloff
Dean, W. G., Dean Applied Technology Co., USA; [2000]; 14p; In English; 36th; Joint Propulsion, 17-19 Jul. 2000, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-98026; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche
    Launching of cryogenic propellants into earth orbit and beyond is very expensive. Each additional pound of payload delivered to low earth orbit requires approximately 35 pounds of additional weight at liftoff. There is therefore a critical need to minimize boiloff in spacecraft long term missions/systems. Various methods have been used to date, including superinsulation and thermodynamic vents to reduce boiloff. A system was designed and tested as described herein that will totally eliminate boiloff. This system is based on a closed-loop, two-stage pulse tube refrigerator with a net refrigeration of four watts at 15k for the recovery of hydrogen propellant. It is designed to operate at 30 Hz which is an order of magnitude higher than other typical pulse tube refrigerators. This high frequency allows the use of a much smaller, lighter weight compressor, This paper describes the system design, fabrication and test results.
Author
Cryogenic Rocket Propellants; Fabrication; Spacecraft Launching; Systems Engineering; Evaporation

20000070429 National Defence Research Establishment, Avd. foer Vapen och Skydd, Stockholm, Sweden
Environmentally Harmful Metals in Additives for Propellants *Skadliga Metaller i Tillsatsmedel till Kanonkrut och Dubbelbasraketkrut*
Lamnevik, S.; Dyhr, K.; Pettersson, M. L.; Jan. 1999; 18p; In Swedish
Report No.(s): PB2000-103138; FOA-R-99-01021-222-SE; No Copyright; Avail: National Technical Information Service (NTIS)
    The aim with the study is to investigate if there are any potential environmentally hazardous metals in the additives used in gun-, howitzer- and double base rocket propellants. For gun- and howitzer propellants this investigation has shown that a mixture is used to clean the barrel from copper. The mixture usually consists of tin (Sn) and lead oxide (PbO). For guns and howitzers in the caliber from 20 to 57 mm the mixture could be mixed directly into the propellant. For calibers in the range from 57 to 155 mm, the mixture is usually in the form of a foil and not mixed into the propellant. Other additives could be lead- or aluminum stearate used during manufacturing of the propellants. Barium nitrate has also been found in one tank propellant. In the case of destruction by burning of gun propellants, lead could be spread if the mixture for de-coppering is mixed into the propellant or if lead stearate has been used during manufacturing. to prevent pollution of lead and tin by destruction by burning of gun propellants, one could put the de-coppering mixture in a foil and remove it before the burning. There is an exhaust of lead during firing of guns if lead oxide is included in the de-coppering mixture or if lead stearate is used during manufacturing. to prevent pollution of lead from gun propellants during destruction or firing of guns, lead oxide should be removed from the de-coppering mixture and lead stearate should be substituted by aluminum stearate. The additives mixed into double base rocket propellants could be different kinds of organic lead compounds and in some cases chromium and copper compounds. The purpose with those additives is to reach a plateau burning effect on the propellant. to prevent exhaust of lead and in some cases also chromium and copper in the case of open burning of double base rocket propellants, one solution could be waste gas cleaning.
NTIS
Propellant Additives; Heavy Metals; Rocket Propellants; Gun Propellants

20000070750 Energy Information Administration, Energy Markets and Contingency Information Div., Washington, DC USA
International Petroleum Monthly: May 2000
May 2000; 82p; In English
Report No.(s): PB2000-106297; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

   The report presents data on international oil production, demand, imports, and stocks. Section 1 contains time series data on world oil production, and on oil demand and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1990, and monthly data for the most recent two years. Section 2 presents an oil supply/demand balance for the world. This balance is presented in quarterly intervals for the most recent two years and annually for the three years prior to that. Section 3 presents data on oil imports by OECD countries. This section contains annual data for the most recent year, quarterly data for the most recent two quarters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, demand, and trade in OECD countries. World oil production and OECD demand data are for the years 1970 through 1999; OECD stocks from 1973 through 1999; and OECD trade from 1988 through 1999.
NTIS
Crude Oil; Economic Development; Fuel Production; Inventories; International Trade

20000070838 Department of Energy, Office of Integrated Analysis and Forecasting, Washington, DC USA
Transportation Sector Module of the World Energy Projection System. Model Documentation Report
Jul. 1999; 36p; In English; Original contains color illustrations
Report No.(s): PB2000-103954; DOE/EIA-M072(99); No Copyright; Avail: National Technical Information Service (NTIS)

   This report documents the objectives, analytical approach, and development of the World Energy Projection System (WEPS) Transportation Energy Model. The report catalogues and describes model assumptions, computational methodology, and parameter estimation approach. This document serves three purposes. First, it is a reference document providing detailed descriptions of the WEPS Transportation Energy model for energy analysis, model users, and the public. Second, this report meets the legal requirements of the Energy Information Administration (EIA) to provide adequate documentation in support of its models (Public Law 94-3895, section 57.b2). Third, it facilitates continuity in model development by providing documentation from which energy analysts can undertake model enhancements, data updates, and parameter refinements as future projects.
NTIS
Transportation Energy; Documentation; Models

20000070853 NASA Glenn Research Center, Cleveland, OH USA
Spot Radiative Ignition and Subsequent Three Dimensional Flame Spread Over Thin Cellulose Fuels
Olson, Sandra L., NASA Glenn Research Center, USA; Kashiwagi, T., National Inst. of Standards and Technology, USA; Kikuchi, M., Tsukuba Space Center, Japan; Fujita, O., Hokkaido Univ., Japan; Ito, K., Hokkaido Univ., Japan; [1999]; 33p; In English; Original contains color illustrations
Contract(s)/Grant(s): C-32001-R; RTOP 101-32-OB; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

   Spontaneous radiative ignition and transition to flame spread over thin cellulose fuel samples was studied aboard the USMP-3 STS-75 Space Shuttle mission, and in three test series in the 10 second Japan Microgravity Center (JAMIC). A focused beam from a tungsten/halogen lamp was used to ignite the center of the fuel sample while an external air flow was varied from 0 to 10 cm/s. Non-piloted radiative ignition of the paper was found to occur more easily in microgravity than in normal gravity. Ignition of the sample was achieved under all conditions studied (shuttle cabin air, 21%-50% O2 in JAMIC), with transition to flame spread occurring for all but the lowest oxygen and flow conditions. While radiative ignition in a quiescent atmosphere was achieved, the flame quickly extinguished in air. The ignition delay time was proportional to the gas-phase mixing time, which is estimated using the inverse flow rate. The ignition delay was a much stronger function of flow at lower oxygen concentrations. After ignition, the flame initially spread only upstream, in a fan-shaped pattern. The fan angle increased with increasing external flow and oxygen concentration from zero angle (tunneling flame spread) at the limiting 0.5 cm/s external air flow, to 90 degrees (semicircular flame spread) for external flows at and above 5 cm/s, and higher oxygen concentrations. The fan angle was shown to be directly related to the limiting air flow velocity. Despite the convective heating from the upstream flame, the downstream flame was inhibited due to the 'oxygen shadow' of the upstream flame for the air flow conditions studied. Downstream flame spread rates in air, measured after upstream flame spread was complete and extinguished, were slower than upstream flame spread rates at the same flow. The quench regime for the transition to flame spread was skewed toward the downstream, due to the augmenting role of diffusion for opposed flow flame spread, versus the canceling effect of diffusion at very low cocurrent flows.
Author
Spontaneous Combustion; Convective Heat Transfer; Diffusion Flames; Flame Propagation; Air Flow; Cellulose; Fuels

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced–gravity environments. For legal aspects of space commercialization see 84 Law, Political Science and Space Policy.

20000068444 Florida Univ., Dept. of Chemical Engineering, Gainesville, FL USA
The Effect of Microgravity on the Growth of Lead Tin Telluride *Final Report*
Narayanan, R., Florida Univ., USA; [2000]; 95p; In English
Contract(s)/Grant(s): NAG1-1474; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The main objective of this research was to present a model for the prediction of the effect of the microgravity environment on the growth of Lead Tin Telluride. The attitude change and its relation to the experimental objectives: The main objective for the AADSF experiment on USMP 3 involving LTT growth was to estimate the effect of ampoule orientation on the axial and radial segregation of tin telluride. As the furnace was not situated on a gimbal there was no possibility to reorient the ampoule during the flight. Instead the only way to change the growth orientation was to change the attitude of the orbiter. This was accomplished by vernier rocket firings. In what follows it must be noted that the orbiter body coordinates are such that the positive z axis points outward from the 'belly', the positive 'x' axis points outwards from the nose and the positive 'y' axis points outwards from the starboard side. The furnace which was in the pay load had its axis aligned with the orbiter's 'z' axis with the hot end closest to the shuttle body. There were basically three orientations that were desired. These corresponded to the ampoule being seen as a heated from above (thermally stable-solutally unstable) configuration, the heated from below (where the instabilities were reversed from the first orientation) configuration and an 'in between' case where the ampoule axis was misaligned with respect to the orbiters 'g(sub z)' axis.
Author
Microgravity; Lead Tellurides; Tin Tellurides; Environmental Tests; Coordinates

20000070802 NASA Marshall Space Flight Center, Huntsville, AL USA
Utilizing Controlled Vibrations in a Microgravity Environment to Understand and Promote Microstructural Homogeneity During Float-Zone Crystal Growth
Anilkumar, A. V., Vanderbilt Univ., USA; Bhowmick, J., Vanderbilt Univ., USA; Grugel, R. N.a, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Materials Science, 7 Jun. 2000, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Our previous experiments with NaNO3 float-zones revealed that steady thermocapillary flow can be balanced/offset by the controlled surface streaming flow induced by end-wall vibration. In the current experiments we are examining the effects of streaming flow on steadying/stabilizing nonsteady thermocapillary flow in such zones. to this effect we have set up a controlled NaNO3 half-zone experiment, where the processing parameters, like zone dimensions and temperature gradients, can be easily varied to generate nonsteady thermocapillary flows. In the present paper we present preliminary results of our investigations into stabilizing such flows by employing end-wall vibration.
Author
Control Surfaces; Crystal Growth; Homogeneity; Microgravity; Microstructure; Vibration; Float Zones

20000072484 NASA Marshall Space Flight Center, Huntsville, AL USA
Microgravity Science Glovebox
Roark, Walt, Mevatec Corp., USA; Cockrell, Dave, NASA Marshall Space Flight Center, USA; Coker, Cindy, NASA Marshall Space Flight Center, USA; Baugher, Charles, NASA Marshall Space Flight Center, USA; [2001]; 1p; In English, 8 Jan. 2001, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS8-40836; No Copyright; Avail: Issuing Activity

The Microgravity Science Glovebox (MSG) is a versatile research facility designed to permit the flexibility of crew manipulated investigations on the International Space Station (ISS). The MSG configuration has been planned around the concept of an experimental workstation where a variety of experiments can be installed and operated in a fashion very similar to their operation in a ground-based laboratory. The approach has been to provide a large working volume with a significant set of power, data and imaging resources, all enclosed, but accessible by the crew through sealed glove ports. This arrangement allows the advantage of interactive experimentation without unduly compromising the experiment design with restrictions imposed by protective and containment challenges that normally arise in manned space-flight laboratories. In addition, the data and imaging resources allow cooperative monitoring of experiment progress between the crew and ground-based scientists. As ISS utilization evolves, the

MSG is scheduled to become a major pathfinder for developing and exploiting the scientific advantages of truly enabling the coupling of experimentation in space with an evaluative response from the crew and investigators.
Author

Microgravity; Experiment Design; Imaging Techniques; Workstations; Flexibility

20000073390 National Academy of Sciences - National Research Council, Huntsville, AL USA

Crystallization of Biological Macromolecules in Microgravity

Snell, Edward H., National Academy of Sciences - National Research Council, USA; Chayen, N. E., NASA Marshall Space Flight Center, USA; Helliwell, J. R., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

An overview of microgravity crystallization explaining why microgravity is used, factors which affect crystallization, the method of crystallization and the environment itself. Also covered is how best to make use of microgravity and what the future might hold.
Author

Crystallization; Macromolecules; Microgravity

20000074073 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Low Temperature Microgravity Physics Experiments Project

Holmes, Warren, Jet Propulsion Lab., California Inst. of Tech., USA; Lai, Anthony, Jet Propulsion Lab., California Inst. of Tech., USA; Croonquist, Arvid, Jet Propulsion Lab., California Inst. of Tech., USA; Chui, Talso, Jet Propulsion Lab., California Inst. of Tech., USA; Eraker, J. H., Ball Aerospace and Technologies Corp., USA; Abbott, Randy, Ball Aerospace and Technologies Corp., USA; Mills, Gary, Ball Aerospace and Technologies Corp., USA; Mohl, James, Ball Aerospace and Technologies Corp., USA; Craig, James, Swales Aerospace, USA; Balachandra, Balu, Swales Aerospace, USA; Gannon, Jade, Swales Aerospace, USA; [2000]; 1p; In English; STAIF-2000, 2000, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Low Temperature Microgravity Physics Facility (LTMPF) is being developed by NASA to provide long duration low temperature and microgravity environment on the International Space Station (ISS) for performing fundamental physics investigations. Currently, six experiments have been selected for flight definition studies. More will be selected in a two-year cycle, through NASA Research Announcement. This program is managed under the Low Temperature Microgravity Physics Experiments Project Office at the Jet Propulsion Laboratory. The facility is being designed to launch and returned to earth on a variety of vehicles including the HII-A and the space shuttle. On orbit, the facility will be connected to the Exposed Facility on the Japanese Experiment Module, Kibo. Features of the facility include a cryostat capable of maintaining super-fluid helium at a temperature of 1.4 K for 5 months, resistance thermometer bridges, multi-stage thermal isolation system, thermometers capable of pico-Kelvin resolution, DC SQUID magnetometers, passive vibration isolation, and magnetic shields with a shielding factor of 80dB. The electronics and software architecture incorporates two VME buses run using the VxWorks operating system. Technically challenging areas in the design effort include the following: 1) A long cryogen life that survives several launch and test cycles without the need to replace support straps for the helium tank. 2) The minimization of heat generation in the sample stage caused by launch vibration 3) The design of compact and lightweight DC SQUID electronics. 4) The minimization of RF interference for the measurement of heat at pico-Watt level. 5) Light weighting of the magnetic shields. 6) Implementation of a modular and flexible electronics and software architecture. The first launch is scheduled for mid-2003, on an H-IIA Rocket Transfer Vehicle, out of the Tanegashima Space Center of Japan. Two identical facilities will be built. While one facility is onboard the ISS, the other is re-integrated on the ground with new experiments. When the cryogen of the facility in space are exhausted, it will be swapped with the other facility with the new experiment. A total of 20 science missions are envisioned over the next 20 years.
Author

Low Temperature Environments; Low Temperature Physics; Microgravity; Gravitational Effects; International Space Station; Japanese Space Program

Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see categories 32 through 39.

20000068486 NASA Marshall Space Flight Center, Huntsville, AL USA

Composite Tank Development

DeLay, Thomas K., NASA Marshall Space Flight Center, USA; May 23, 2000; 10p; In English; SAMPE 2000, 21-25 May 2000, Long Beach, CA, USA

Report No.(s): CDDF-96-02; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents viewgraphs on composite tank development. There is a need for oxidizer tanks and reliable, lightweight fuel. The need for cost-effective and scalable manufacturing is also evident. In order to achieve these goals, tooling methods for tank development must be applied, methods for producing easily adaptable and scalable vessel liners must be developed, insulation layer or protective barriers for containers must be manufactured, and an appropriate fiber/resin system for composite overwrap structures must be identified.

CASI

Composite Structures; Manufacturing; Tanks (Containers); Cryogenic Fluid Storage

20000070329 Air Force Research Lab., Materials and Manufacturing Directorate, Tyndall AFB, FL USA

P-18 Suspension Roll Stability Test *Final Report, Jan.-Oct. 1999*

Kalberer, Jennifer L.; Davis, Leo W.; Apr. 2000; 51p; In English

Contract(s)/Grant(s): F08637-98-C-6001

Report No.(s): AD-A377849; AFRL-ML-TY-TR-2000-4517; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Aircraft Rescue and Fire Fighting (ARFF) community and U.S. Military Organizations have experienced several Emergency Response Vehicle rollover induced accidents in recent years. The Air Force has a large inventory of P-18 water tankers (194) and P-19 ARFF vehicles (399) that are subject to rollover incidents. These vehicles are expected to remain in service for at least 15 years. As a near-term solution., retrofitting the suspension system to increase stability may be the only option available at the present time. This report documents the results of testing a P-18 modified with Davis Technologies International (DTI) strut units. Phase I involved testing the P-18 in its current suspension configuration to establish a baseline set of performance data. Phase II involved retrofitting and testing the P-18 with six DTI strut units (one per wheel end). Testing of the P-18 with the DTI suspension system showed that the vehicle could be operated at increased speeds of 10-30% before loss of vehicle control was observed. In most cases the lateral acceleration required to roll the vehicle was increased to the lateral acceleration at tire slip, so the vehicle was more likely to experience a controlled loss, or slide-out, rather than actual rollover.

DTIC

Dynamic Tests; Rescue Operations; Stability Tests; Emergencies

20000070721 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Continuous Adiabatic Demagnetization Refrigerator for Use with Mechanical Coolers

Shirron, P., NASA Goddard Space Flight Center, USA; Abbondante, N., Worcester Polytechnic Inst., USA; Canavan, E., NASA Goddard Space Flight Center, USA; DiPirro, M., NASA Goddard Space Flight Center, USA; Grabowski, M., Worcester Polytechnic Inst., USA; Hirsch, M., Worcester Polytechnic Inst., USA; Jackson, M., NASA Goddard Space Flight Center, USA; Tuttle, J., NASA Goddard Space Flight Center, USA; Jan. 01, 2000; 5p; In English; International Cryocooler Conference, 20-22 Jun. 2000, Keystone, CO, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have begun developing an adiabatic demagnetization refrigerator (ADR) which can produce continuous cooling at temperatures of 50 mK or lower, with high cooling power (goal of 10 PW). The design uses multiple stages to cascade heat from a continuously-cooled stage up to a heat sink. The serial arrangement makes it possible to add stages to extend the operating range to lower temperature, or to raise the heat rejection temperature. Compared to conventional single-shot ADRS, this system achieves higher cooling power per unit mass and is able to reject its heat at a more uniform rate. For operation with a mechanical cryocooler, this latter feature stabilizes the heat sink temperature and allows both the ADR and cryocooler to operate more efficiently. The ADR is being designed to operate with a heat sink as warm as 10-12 K to make it compatible with a wide variety of mechanical coolers as part of a versatile, cryogen-free low temperature cooling system. A two-stage system has been constructed and a proof-

of-principle demonstration was conducted at 100 mK. Details of the design and test results, as well as the direction of future work, are discussed.
Author

Adiabatic Conditions; Cryogenics; Refrigerating Machinery; Refrigerators; Cryogenic Cooling; Cryogenic Equipment; Adiabatic Demagnetization Cooling

20000070727 NASA Goddard Space Flight Center, Greenbelt, MD USA

Thermal Consideration of SWIFT XRT Radiator At-35C or Colder in Low Earth Orbit

Choi, Michael K., NASA Goddard Space Flight Center, USA; [2000]; 10p; In English; 35th; 35th Intersociety Energy Conversion Engineering Conference, 24-27 Jul. 2000, Las Vegas, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2000-2906; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

The X-Ray Telescope (XRT) is an instrument on the National Aeronautics and Space Administration (NASA) SWIFT spacecraft. The thermoelectric cooler (TEC) for the charge coupled device (CCD) of the XRT requires a radiator temperature of -35 C or colder, and a goal of -55 C to minimize the damage by radiation. The waste heat rejected from the TEC to the radiator is in the 8 W to 20 W range. In the Phase A baseline design, the XRT radiator is mounted to the rear end of the XRT telescope tube and is very close to the bottom closeout of the spacecraft bus. The bottom closeout is multi-layer insulation (MLI) blankets. At sun angles between 90 deg and 180 deg, there is direct solar impingement on the bottom closeout. When the rolls +/- 5 deg, the XRT radiator is exposed to direct solar radiation. The radiator also has a view factor to the solar arrays. The results of thermal analysis showed that the flight temperature prediction of the radiator exceeds the temperature requirement of -35 C substantially at sun angles from 110 deg to 180 deg. A new location on the anti-sun side of the spacecraft is proposed for the radiator. It requires a heat pipe to couple the TEC and the radiator thermally. The results of thermal analysis show that the flight temperature prediction of the proposed radiator meets the temperature requirement at all sun angles.
Author

Charge Coupled Devices; Coolers; X Ray Telescopes; Thermal Analysis; Multilayer Insulation; Heat Radiators

20000070759 Helsinki Univ. of Technology, Lab. of Heating, Ventilation and Air Conditioning, Espoo, Finland

Report of Academic Year 1998/1999 (Helsinki University of Technology, Laboratory of Heating, Ventilating and Air-Conditioning), *1998-1999*

Salo, Pirkko, Editor, Helsinki Univ. of Technology, Finland; 2000; 106p; In English

Report No.(s): PB2000-105583; Copyright; Avail: National Technical Information Service (NTIS)

The laboratory organizes the teaching for students majoring in Indoor Climate and Energy Economy of Building in which students still have two options: Indoor Climate of Buildings and Energy Economy of Buildings. The laboratory also teaches heating, ventilating, and air conditioning HVAC technology for architectural and civil engineering students. The well-equipped laboratory for heating, ventilating and air conditioning is used for teaching and research projects. It also offers good opportunties to thesis work on all levels. Its research projects serve both the Finnish industry and governmental agencies.
NTIS

Air Conditioning; Space Heating (Buildings); Research; Ventilation; Heating

20000072446 D. N. American, Fairmont, WV USA

Center Initiative Management (CIM) Tool Functional Requirements Document for the Science and Engineering Technical Assessments (SETA) Program *Final Report*

Jul. 14, 2000; 26p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS2-98028

Report No.(s): Rept-8521.01.062700; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document summarizes the functional requirements identified by the Science and Engineering Technical Assessments (SETA) Contractor for the Center Initiative Management (CIM) Tool.
Author

Functional Design Specifications; Management Information Systems; NASA Programs

20000073231 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

CSP Manufacturing Challenges and Assembly Reliability

Ghaffarian, Reza, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Although the expression of CSP is widely used by industry from suppliers to users, its implied definition had evolved as the technology has matured. There are "expert definition"- package that is up to 1.5 time die- or "interim definition". CSPs are miniature new packages that industry is starting to implement and there are many unresolved technical issues associated with their implementation. For example, in early 1997, packages with 1 mm pitch and lower were the dominant CSPs, whereas in early 1998 packages with 0.8 mm and lower became the norm for CSPs. Other changes included the use of flip chip die rather than wire bond in CSP. Nonetheless the emerging CSPs are competing with bare die assemblies and are becoming the package of choice for size reduction applications. These packages provide the benefits of small size and performance of the bare die or flip chip, with the advantage of standard die packages. The JPL-led MicrotypeBGA Consortium of enterprises representing government agencies and private companies have jointed together to pool in-kind resources for developing the quality and reliability of chip scale packages (CSPs) for a variety of projects. This talk will cover specifically the experience of our consortium on technology implementation challenges, including design and build of both standard and microvia boards, assembly of two types of test vehicles, and the most current environmental thermal cycling test results.

Author

Manufacturing; Assembly; Environmental Tests; Reliability; Test Vehicles; Industries

20000073733 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA

JADS Special Report on the Costs and Benefits of Distributed Testing

Roane, Michael; Slatery, Norma; Dec. 1999; 64p; In English

Report No.(s): AD-A377761; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The Joint Advanced Distributed Simulation (JADS) Joint Test and Evaluation (JT&E) chartered for support of distributed testing and development test and evaluation (DT&E) and operational test and evaluation (OT&E). This special report provides insight in to the benefits and cost associated with the use of distributed testing in development and operational testing. It provides program managers (PMs) with findings, conclusions and lessons learned from the three JADS test and other agencies regarding the cost and benefits of using distributed testing. This combined effort consists of two sections. The first part describes the potential benefits and cost savings arising from the incorporation of distributed testing. The second half introduces a work breakdown structure (WBS) format to support the assessment of the costs and the risk of incorporating distributed testing into the T&E process. Additionally, the second half identify cost drivers and areas of potential risk. These recommendations focus on the global T&E community needs and , if followed, will help PMs to better conduct distributed testing.

Derived from text

Cost Reduction; Performance Tests; Evaluation

20000073847 NASA Marshall Space Flight Center, Huntsville, AL USA

Application of Rapid Prototyping to the Investment Casting of Test Hardware (MSFC Center Director's Discretionary Fund Final Report, Project No. 98-08)

Cooper, K. G., NASA Marshall Space Flight Center, USA; Wells, D., NASA Marshall Space Flight Center, USA; June 2000; 26p; In English

Report No.(s): NASA/TM-2000-210384; M-983; NAS 1.15:210384; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Investment casting masters of a selected propulsion hardware component, a fuel pump housing, were rapid prototyped on the several processes in-house, along with the new Z-Corp process acquired through this project. Also, tensile samples were prototyped and cast using the same significant parameters. The models were then shelled in-house using a commercial grade zircon-based slurry and stucco technique. Next, the shelled models were fired and cast by our in-house foundry contractor (IITRI), with NASA-23, a commonly used test hardware metal. The cast models are compared by their surface finish and overall appearance (i.e., the occurrence of pitting, warping, etc.), as well as dimensional accuracy.

Author

Investment Casting; Prototypes; Slurries; Propulsion; Hardware

20000074079 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Fast Alternative Cryogenic Experiment Testbed

Nash, Alfred, Jet Propulsion Lab., California Inst. of Tech., USA; Holmes, Warren, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

One of the challenges in the area of cryogenics for space exploration in the next millennium is providing the capability for inexpensive, frequent, access to space. Faced with this challenge during the International Space Station (ISS) build era, when other Space Shuttle manifesting opportunities are unavailable, a "proof of concept" cryostat has been developed to demonstrate the

ability to accommodate low temperature science investigations within the constraints of the Hitchhiker siderail carrier. The Hitchhiker siderail carrier is available on a "mass available" basis during the ISS build era. In fact, several hitchhiker payloads flew with the deployment of the Unity module. Hitchhiker siderail carrier payloads have historically flown an average of about four times a year. A hybrid Solid Neon - Superfluid Helium cryostat has been developed with Janis Research Company to accommodate instruments of 16.5 cm diameter and 30 cm. length. This hybrid approach was taken in part to provide adequate on-orbit lifetime for instruments with high (conducted) heat loads from the instrumentation wiring. Mass, volume, lifetime and the launch hold scenario were all design drivers. In addition, with Ball Aerospace and Technologies Corporation, a multichannel VME architecture Germanium Resistance Thermometer (GRT) readout and heater control servo system has been developed. In a flight system, the cryostat and electronics payloads would be umbilically attached in a paired Hitchhiker siderail mount, and permit on-orbit command and telemetry capability. The results of performance tests of both the cryostat, and a helium sample instrument will be presented. The instrument features a self contained, miniaturized, nano-Kelvin resolution High Resolution Thermometer (HRT). This high level of thermal resolution is achieved through the utilization of a dc Superconducting Quantum Interference Device (SQUID). Although developed for the Low Temperature Microgravity Fundamental Physics investigator community, many design features are applicable in fields such as infrared and x-ray astronomy.

Author

Cryostats; Germanium; Heaters; Helium; Liquid Helium 2; Low Temperature; Microgravity; Performance Tests; Resistance Thermometers; Solid Cryogens; Squid (Detectors); Fabrication

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COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 Space Communications, Spacecraft Communications, Command and Tracking; for search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation and Safety.

20000068525 Naval Postgraduate School, Monterey, CA USA

Probability of Symbol Error for Coherent and Non-Coherent Detection of M-ary Frequency-Shift Keyed (MFSK) Signals Affected by Co-Channel Interference and Additive White Gaussian Noise (AWGN) in a Fading Channel

Argyriou, Andreas; Mar. 2000; 307p; In English

Report No.(s): AD-A376826; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The probability of symbol error for coherent and non-coherent detection of M-ary frequency-shift keyed (MFSK) signals affected by other interfering MFSK signals (co-channel interference) and additive white Gaussian noise (AWGN) in a fading channel (Rayleigh and Rician models) is quantified in this thesis. First, theoretical expressions are derived for the symbol error probability as a function of the signal-to-noise ratio SNR and the signal-to-interference/jamming ratio SJR. Next, using SIMULINK and the MATLAB/SIMULINK Communications Toolbox, we develop models to determine the symbol error probability for Monte Carlo type simulations. Finally, we compare the theoretical symbol error probabilities with the simulation's results and identify the differences and their possible causes.

DTIC

Frequency Shift; Signal Processing; Fading; Electromagnetic Interference; Monte Carlo Method

20000068533 NASA Glenn Research Center, Cleveland, OH USA

A K-Band Linear Phased Array Antenna Based on Ba0.60SR0.40TiO3 Thin Film Phase Shifters

Romanofsky, R., NASA Glenn Research Center, USA; Bernhard, J., Illinois Univ., USA; Washington, G., Ohio State Univ., USA; VanKeuls, F., Ohio Aerospace Inst., USA; Miranda, F., NASA Glenn Research Center, USA; Cannedy, C., Maryland Univ., USA; [2000]; 4p; In English; IEEE International Microwave Symposium, Jun. 2000, Boston, MA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): RTOP 632-6E-51; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper summarizes the development of a 230675 GHz linear 16-element scanning phased array antenna based on thin ferroelectric film coupled microstripline phase shifters and microstrip patch radiators.

Author

Antenna Arrays; Microstrip Antennas; Thin Films; Phase Shift; Phased Arrays; Linear Arrays

20000068968 Technische Univ., Dept. of Mathematics and Computing Science, Eindhoven Netherlands

Analysis of a Single-Server Queue Interacting with a Fluid Reservoir

Adan, I. J. B. F.; vanDoorn, E. A.; Resing, J. A. C.; Scheinhardt, W. R. W.; Oct. 1997; 34p; In English

Report No.(s): PB2000-104932; MEMO-COSOR-97-20; No Copyright; Avail: National Technical Information Service (NTIS)

The authors consider a single-server queuing system with Poisson arrivals in which the speed of the server depends on whether an associated fluid reservoir is empty or not. The authors' interest focuses on the stationary joint distribution of the number of customers in the system and the content of the fluid reservoir, from which various performance measures such as the steady-state sojourn time distribution of a customer may be obtained. The authors study two variants of the system. For the first, in which the fluid reservoir is infinitely large, the authors present an exact analysis. The variant in which the fluid reservoir is finite, is analyzed approximately through a discretization technique. The system may serve as a mathematical model for a traffic regulation mechanism -a two-level traffic shaper - at the edge of an ATM network, regulating a very bursty source. the authors present some numerical results showing the effect of the mechanism.

NTIS

Reservoirs; Communication Networks; Queueing Theory

20000069646 George Mason Univ., School of Information Technology and Engineering, Fairfax, VA USA

MMSE Beamforming With Quadratic Quiescent Pattern Constraints for Circular Array STAP *Final Report, 1 May 1999-31 Dec 2000*

Bell, Kristine L.; Van Trees, Harry L.; Griffiths, Lloyd J.; Mar. 31, 2000; 20p; In English

Contract(s)/Grant(s): N00014-99-1-0691

Report No.(s): AD-A377579; C3I-SSAP-00-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this project was to develop new and innovative processing methods for clutter and interference mitigation for Space-Time Adaptive Processing (STAP) with circular arrays. The focus was on developing a robust minimum mean square error (MMSE) beamforming technique using quadratic quiescent pattern constraints (MMSE-QPC) that works with arbitrary array configurations, including the circular UHF Electronically Scanned Array (UESA) and the standard linear array. The MMSE-QPC technique provides a general framework for quiescent and adaptive space-time beampattern synthesis which provides both main beam and sidelobe control with reasonable computational complexity. Beampattern control is achieved by imposing a set of inequality constraints on the weighted mean-square error between the adaptive pattern and a desired beampattern over a set of angle-Doppler regions. An iterative procedure for satisfying the constraints is developed which can be applied as post-processing to standard MMSE beamformers. The algorithm is used to synthesize a nearly uniform sidelobe level quiescent pattern for the UESA, and to control sidelobe levels for the same array in an adaptive manner. Performance results using data provided by Lincoln Lab show that under low sample support conditions, sidelobes can be effectively suppressed while maintaining high signal-to-interference plus noise ratio, and deep nulls on clutter and interferers.

DTIC

Beamforming; Sidelobes; Ultrahigh Frequencies; Antenna Arrays; Airborne Radar; Mean Square Values

20000069777 Research Inst. of National Defence, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden

Mobility Models for Mobile Radio Networks *Mobilitetsmodeller foer Mobila Radionaet*

Sterner, U.; Jun. 1999; 90p; In Swedish; Original contains color illustrations

Report No.(s): PB2000-103048; FOA-R-99-01157-504-SE; No Copyright; Avail: National Technical Information Service (NTIS)

In this report two mobility models are proposed for the nodes in mobile radio networks. These models have been evaluated together with an existing model from BBN Technologies which is used in DARPA's GloMo-program. In all the models, it is possible to arrange the nodes in groups, and vary the degree of moment. In one of the proposed mobility models, the nodes' movements are terrain dependent. To be able to estimate the degree of movement in a mobility model a mobility measure is proposed. As an example, the average length of life of an STDMA-scheme is studied, for different mobility models.

NTIS

Mobility; Mobile Communication Systems; Radio Communication; Communication Networks

20000069780 National Defence Research Establishment, Div. of Human Sciences, Linkoeping, Sweden

Using Mobile Agents to Collect Data in Distributed Command and Control Systems *Mobila Agenter foer Datainsamling i Distribuerade Ledningssystem*

Soederberg, H.; Wikberg, P.; Jan. 1999; 38p; In Swedish

Report No.(s): PB2000-103067; FOA-R-99-01008-505-SE; No Copyright; Avail: National Tech. Information Service (NTIS)

In modern command and control systems, as well as other digital networks, digital agents are used for a great number of different tasks, for example to update decision support systems from a central server or to subscribe or detect different kinds of information. This ability could be used for data collection in mobile distributed command and control systems. With digital registrations of how different decision support systems are used, how orders are distributed, etc., a better picture of the command and control process could be achieved. The purpose of this study was to evaluate whether the agent builder tool Aglets from IBM could be a suitable platform to generate agents with such data collection tasks. The study was performed in a local network where mobile agents were used to follow communications between different computers and users. The agents were assigned questions about how different military orders were distributed according to a given scenario in a network system. The results show that mobile agents may well be used for this kind of data collection, but a considerably better platform is needed. The study also indicates that a better methodology in the preparation phase is needed when the measurement criteria are developed, as these criteria are of significant importance for the agents' ability to collect valid and reliable data.

NTIS

Command and Control; Data Management; Automatic Control

20000070372 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Interferometric Propagation Delay

Goldstein, Richard, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 18; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Radar interferometry based on (near) exact repeat passes has lately been used by many groups of scientists, worldwide, to achieve state of the art measurements of topography, glacier and ice stream motion, earthquake displacements, oil field subsidence, lava flows, crop-induced surface decorrelation, and other effects. Variations of tropospheric and ionospheric propagation delays limit the accuracy of all such measurements. We are investigating the extent of this limitation, using data from the Shuttle radar flight, SIR-C, which is sensitive to the troposphere, and the Earth Resources Satellites, ERS-1/2, which are sensitive to both the troposphere and the ionosphere. We are presently gathering statistics of the delay variations over selected, diverse areas to determine the best accuracy possible for repeat track interferometry. The phases of an interferogram depend on both the topography of the scene and variations in propagation delay. The delay variations can be caused by movement of elements in the scene, by changes in tropospheric water vapor and by changes of the charge concentrations in the ionosphere. We plan to separate these causes by using the data from a third satellite visit (three-pass interferometry). The figure gives the geometry of the three-pass observations. The page of the figure is taken to be perpendicular to the spacecraft orbits. The three observational locations are marked on the figure, giving baselines B-12 and B-13, separated by the angle alpha. These parameters are almost constant over the whole scene. However, each pixel has an individual look angle, theta, which is related to the topography, rho is the slant range. A possible spurious time delay is shown. Additional information is contained in the original.

Author

Interferometry; Satellite Observation; Time Lag; Topography; Atmospheric Attenuation; Electromagnetic Scattering; Delay; Radar Attenuation; Electromagnetic Absorption

20000070428 National Defence Research Establishment, Avedelningen foer NBC Skydd, Umea, Sweden

COM-Dart Communication Interface for TS9000 *Final Report COM-Dart: Kommunikationsinterface foer TS9000. Slutrapport*

Larsson, H. G.; Lidstroem, K.; Nyholm, S.; Rejnus, L.; Apr. 1999; 46p; In Swedish; Original contains color illustrations

Report No.(s): PB2000-103135; FOA-R-99-01120-865-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report gives a description of the function of the communication interface COM-Dart. COM-Dart is connected to the RA180 and can automatically send information from instruments and sensors via TS9000, e.g. to the command and control system LIM/MAST. The command and control system contains a decision support application, that for instance can present the risk area on the actual map. A proposal for a possible training/simulation system with COM-Dart is given in the report.

NTIS

Decision Support Systems; Command and Control; Active Control

20000070439 Texas Univ., Dept. of Electrical and Computer Engineering, Austin, TX USA

Radar Image Enhancement, Feature Extraction and Motion Compensation Using Joint Time-Frequency Techniques *Annual Report, 15 Apr. 1999-15 Apr. 2000*

Hao, Ling, Texas Univ., USA; May 15, 2000; 64p; In English

Contract(s)/Grant(s): N00014-98-1-0615

Report No.(s): AD-A377783; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This report summarizes the scientific progress on the research grant "Radar Image Enhancement, Feature Extraction, and Motion Compensation Using Joint Time-Frequency Techniques" during the period 15 April 1999-14 April 2000. Progress on processing of NATO TIRA and MERIC radar data, removal of image artifacts due to jet engine modulation, and three-dimensional motion detection and compensation is presented.

DTIC

Radar Imagery; Frequencies; Image Enhancement; Three Dimensional Motion; Pattern Recognition

20000070454 Defence Evaluation Research Agency, UK

The Technical Cooperation Program. Trends and Applications in Common Operating Environments and Distributed Computing Environments: 2nd Edition with COE Security Appendix

Laws, John, Defence Evaluation Research Agency, UK; Macleod, Iain, Defence Science and Technology Organisation, Australia; Robinson, John L., Communications Research Centre, Canada; Tindle, John, Defence Evaluation Research Agency, UK; DeFranco, Carl A., Air Force Research Lab., USA; Apr. 2000; 102p; In English

Report No.(s): AD-A377557; TTCP-C3I-TP-10; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

To support the global C41 missions of the future, with their emphasis on rapid deployment, reach back, timely response and multiple mission capability, requires a seamless information environment from the sensors to the execution elements. The goal is to provide the right information, at the right time and the right place. Physically this will be implemented as a collection of inter-connected information processing centers, each supporting a specific portion of the mission (e.g. planning, logistics, intelligence, monitoring, assessment, etc.). These centers will be functionally integrated to provide the perception of a single, uniform, information environment, which provides to all of the users a common, consistent and current view of needed information, even though the users and the information sources may all be physically dispersed around the globe.

DTIC

Data Processing; Information Systems; Computer Information Security; Operating Systems (Computers); Distributed Processing

20000070460 Global Science and Technology, Inc., Greenbelt, MD USA

Autonomous Data Transfer Operations for Missions

Repaci, Max, Global Science and Technology, Inc., USA; Baker, Paul, Global Science and Technology, Inc., USA; Brosi, Fred, Global Science and Technology, Inc., USA; [2000]; 4p; In English; SpaceOps 2000, 19-23 Jun. 2000, Toulouse, France; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Automating the data transfer operation can significantly reduce the cost of moving data from a spacecraft to a location on Earth. Automated data transfer methods have been developed for the terrestrial Internet. However, they often do not apply to the space environment, since in general they are based on assumptions about connectivity that are true on the Internet but not on space links. Automated file transfer protocols have been developed for use over space links that transfer data via store-and-forward of files or segments of files. This paper investigates some of the operational concepts made possible by these protocols.

Author

Autonomy; Data Transfer (Computers); Cost Reduction; Transferring

20000070557 Defence Research Establishment Ottawa, Ottawa, Ontario Canada

On the Application of the Parks-McClellan Algorithm to the Design of Quadrature Demodulation Filters

Inkol, R.; Nguyen, D. P.; June 1999; 86p; In English

Report No.(s): AD-A368679; DREO-TR-1999-063; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

New results are presented concerning the use of the Parks-McClellan algorithm to design filters for digital quadrature demodulators based on quadrature mixing and lowpass filtering concepts. The use of a 4:1 ratio between the sampling rate and intermediate frequency to reduce computational cost complicates this problem. Since the in-phase (I) and quadrature (Q) filters become odd and even length filters, respectively, the matching of the passband gains becomes an important error source. Consequently, the problem is to find the best design for a pair of filters rather than the best design for a single filter. One issue is whether to design the I and Q filters separately, or derive them from a prototype filter. Another concerns techniques for designing fractional-band filters if these are desired. The performance data presented in this paper shows that the quadrature demodulator accuracy has a complex dependence on the approach and specifications used to design the filters. Since good matching of the filter gains in the passband occurred only under certain conditions, significant performance losses can occur unless some care is taken in designing the filters.

DTIC

Signal Processing; Demodulation; Digital Filters; Algorithms; Demodulators; Prototypes; Quadratures

20000070664 Helsinki Univ. of Technology, Lab. of Signal Processing and Computer Technology, Helsinki, Finland

Helsinki University of Technology Laboratory of Signal Processing and Computer Technology *Annual Report, 1999*

2000; 56p; In English; See also PB99-161218

Report No.(s): PB2000-105593; Rept-28; Copyright; Avail: National Technical Information Service (NTIS)

The paper contains the following sections: Baseband Processing Unit for LALAMO-Project; Base-station unit for WLAN; Statistical Signal Processing; Research on Discrete Transforms and Their Systolic Implementation; Research on Crypography Algorithms; Enhanced fast power control of WCDMA system; Participation in Conferences and Seminars; Participation in Boards and Committees.

NTIS

Signal Processing; Radio Transmission; Computer Systems Design

20000070665 Helsinki Univ. of Technology, Telecommunications Software and Multimedia Lab., Espoo, Finland

Proceedings of the Seminar on Telecommunications Architectures '00

Karvo, Jouni, Editor, Helsinki Univ. of Technology, Finland; 2000; 80p; In English; Telecommunications Architectures 2000, 2000, USA; See also PB99-161267

Report No.(s): PB2000-105591; TML-C6; Copyright; Avail: National Technical Information Service (NTIS)

The Seminar on Telecommunications Architectures, Tik-109.550, spring 2000, is a post-graduate course at Helsinki University of Technology. This year, the course topic was IP network management. The seminar presentations are assembled into this book. It may be argued that a high level model from the telecom world, such as TMN service provisioning model can also be used for IP networks. The first presentation presents this model. Next, an important new property of an IP network, namely mobility is addressed. As a possible service needing management concerns, VoIP may play significant role in future convergent networks. New services need quality properties from the connections in the network, and these are also addressed. Finally, making distributed applications over the IP networks arises some new management problems, which are addressed in the last paper.

NTIS

Telecommunication; Architecture (Computers); Communication Networks

20000070766 Federal Communications Commission, Washington, DC USA

New Federal Communications Commission for the 21st Century

2000; 34p; In English; Original contains color illustrations

Report No.(s): PB2000-106056; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Congress enacted the Communications Act of 1934 to provide for the widest dissemination of communications services to the public. Section 1 of the Communications Act states that the purpose of the Act is to 'make available to all the people of the USA, without discrimination, a rapid, efficient, Nation-wide, and world-wide wire and radio communication service at reasonable charges.' This goal remains vibrant today. What has changed since 1934 is the means to get to this goal. With the passage of the Telecommunications Act of 1996 (Telecom Act), Congress recognized that competition should be the organizing principle of our communications law and policy and should replace micromanagement and monopoly regulation. The wisdom of this approach has been proven in the long distance, wireless, and customer premises equipment markets, where competition took hold and flourished, and consumers receive the benefit of lower prices, greater choices, and better service. The imperative to make the transition to fully competitive communications markets to promote the widest deployment of communications services is more important today than ever before.

NTIS

Competition; Regulations; Radio Communication

20000072486 Boeing Co., Saint Louis, MO USA

Integrated Circuit Immunity

Sketoe, J. G., Boeing Co., USA; Clark, Anthony, NASA Marshall Space Flight Center, USA; [2000]; 16p; In English; Electromagnetic Environmental Effects Review Meeting, 11-14 Apr. 2000, Orlando, FL, USA; Sponsored by Department of Defense, USA

Contract(s)/Grant(s): NAS8-98217; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a DOD E3 program overview on integrated circuit immunity. The topics include: 1) EMI Immunity Testing; 2) Threshold Definition; 3) Bias Tee Function; 4) Bias Tee Calibration Set-Up; 5) EDM Test Figure; 6) EMI Immunity Levels; 7) NAND vs. and Gate Immunity; 8) TTL vs. LS Immunity Levels; 9) TP vs. OC Immunity Levels; 10) 7805 Volt Reg Immunity; and 11) Seventies Chip Set. This paper is presented in viewgraph form.

CASI

Integrated Circuits; Electrical Engineering

20000073252 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA

Electronic Warfare Test, Phase 2 *Interim Report*

Wright, Darrell L.; Sep. 1999; 137p; In English

Report No.(s): AD-A377902; JADS/JTE-TR-99-013; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

    The tasking to conduct an ADS-based EW test called for an airborne self-protection jammer (SPJ) as the system under test (SUT). The emphasis of the EW Test was on the performance of the ADS components and their contribution or impact to testing rather than on the performance of the SPJ pod itself. Measures of performance (MOPs) for the SPJ were identified as measures that would most likely be affected by distributed testing. Statistical comparison of the MOPs became the methodology for evaluating ADS. JADS evaluated distributed test control and analysis, network performance, relationships between data latencies, and ADS-induced data anomalies. Time, cost, and complexity, as well as validity and credibility of the data, were part of the evaluation. The EW Test was designed as a three-phase effort. The first phase provided a baseline of jammer performance data in a non-ADS environment that was then compared to the data collected in the second and third phases using an ADS environment. The second phase used a digital system model of the SPJ representing an early developmental test. The third phase used the SPJ mounted on the aircraft that was suspended in an installed systems test facility. This test represented a combined integration and effectiveness test that would occur late in the SPJ development.

DTIC

Jamming; Security; Active Control; Electronic Warfare; Strategy

20000073711 Naval Postgraduate School, Monterey, CA USA

Resolving Frequency Ambiguities in Step-Frequency Compressive Receivers

Ceylan, Oktay; Dec. 1999; 143p; In English

Report No.(s): AD-A374376; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

    Present Compressive Receiver implementations are limited due to their analog implementation and the necessity for digital processing of the serial output data. Previous research has shown that a stepped-frequency digital design using sub-Nyquist sampling mitigates many of the limitations. An algorithm that implements the Chinese Remainder Theorem to solve the frequency ambiguities that occur in the design due to sub-Nyquist sampling with high resolutions is investigated. Different resolutions, a different number of sampling frequencies, and sampling frequency pairs and triples with various differences are simulated for one to five signals that overlap in the time domain. Predictions for the best achievable resolution, the minimum number of sampling frequencies needed, and the difference required between the sampling frequencies are made according to the comparison of simulation results.

DTIC

Receivers; Frequencies; Digital Systems; Ambiguity

20000074066 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Calibration of the Geosar Dual Frequency Interferometric SAR

Chapine, Elaine, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

    GeoSAR is an airborne, interferometric Synthetic Aperture Radar (INSAR) system for terrain mapping, currently under development by a consortium including NASA's Jet Propulsion Laboratory (JPL), Calgis, Inc., and the California Department of Conservation (CalDOC) with funding provided by the Topographic Engineering Center (TEC) of the U.S. Army Corps of Engineers and the Defense Advanced Research Projects Agency (DARPA). The radar simultaneously maps swaths on both sides of the aircraft at two frequencies, X-Band and P-Band. For the P-Band system, data is collected for two across track interferometric baselines and at the crossed polarization. The aircraft position and attitude are measured using two Honeywell Embedded GPS Inertial Navigation Units (EGI) and an Ashtech Z12 GPS receiver. The mechanical orientation and position of the antennas are actively measured using a Laser Baseline Metrology System (LBMS). In the GeoSAR motion measurement software, these data are optimally combined with data from a nearby ground station using Ashtech PNAV software to produce the position, orientation, and baseline information are used to process the dual frequency radar data. Proper calibration of the GeoSAR system is essential to obtaining digital elevation models (DEMS) with the required sub-meter level planimetric and vertical accuracies. Calibration begins with the determination of the yaw and pitch biases for the two EGI units. Common range delays are determined for each mode, along with differential time and phase delays between channels. Because the antennas are measured by the LBMS, baseline calibration consists primarily of measuring a constant offset between mechanical center and the electrical phase center of the antennas. A phase screen, an offset to the interferometric phase difference which is a function of absolute phase, is applied to the interferometric data to compensate for multipath and leakage. Calibration parameters are calculated for each of the ten processing modes, each of the operational bandwidths (80 and 160 MHZ), and each aircraft altitude. In this talk we will discuss the layout

calibration sites, the synthesis of data from multiple flights to improve the calibration, methods for determining time and phase delays, and techniques for determining radiometric and polarimetric quantities. We will describe how calibration quantities are incorporated into the processor and pre-processor. We will demonstrate our techniques applied to GeoSar data and assess the stability and accuracy of the calibration. This will be compared to the modeled performance determined from calibrating the output of a point target simulator. The details of baseline determination and phase screen calculation are covered in related talks.
Author
Airborne Equipment; Calibrating; Interferometry; Synthetic Aperture Radar; Multispectral Radar

20000074067 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Utility and Validity of Kinematic GPS Positioning for the Geosar Airborne Terrain Mapping Radar System
Freedman, Adam, Jet Propulsion Lab., California Inst. of Tech., USA; Hensley, Scott, Jet Propulsion Lab., California Inst. of Tech., USA; Chapin, Elaine, Jet Propulsion Lab., California Inst. of Tech., USA; Kroger, Peter, Jet Propulsion Lab., California Inst. of Tech., USA; Hussain, Mushtaq, Calgis, Inc., USA; Allred, Bruce, Calgis, Inc., USA; [1999]; 1p; In English; Session 1: Kinematic Application of GPS Technology to Earth Sciences, USA; No Copyright; Avail: Issuing Activity; Abstract Only

GeoSAR is an airborne, interferometric Synthetic Aperture Radar (IFSAR) system for terrain mapping, currently under development by a consortium including NASA's Jet Propulsion Laboratory (JPL), Calgis, Inc., a California mapping sciences company, and the California Department of Conservation (CaIDOC), with funding provided by the U.S. Army Corps of Engineers Topographic Engineering Center (TEC) and the U.S. Defense Advanced Research Projects Agency (DARPA). IFSAR data processing requires high-accuracy platform position and attitude knowledge. On 9 GeoSAR, these are provided by one or two Honeywell Embedded GPS Inertial Navigation Units (EGI) and an Ashtech Z12 GPS receiver. The EGIs provide real-time high-accuracy attitude and moderate-accuracy position data, while the Ashtech data, post-processed differentially with data from a nearby ground station using Ashtech PNAV software, provide high-accuracy differential GPS positions. These data are optimally combined using a Kalman filter within the GeoSAR motion measurement software, and the resultant position and orientation information are used to process the dual frequency (X-band and P-band) radar data to generate high-accuracy, high -resolution terrain imagery and digital elevation models (DEMs). GeoSAR requirements specify sub-meter level planimetric and vertical accuracies for the resultant DEMS. to achieve this, platform positioning errors well below one meter are needed. The goal of GeoSAR is to obtain 25 cm or better 3-D positions from the GPS systems on board the aircraft. by imaging a set of known point target corner-cube reflectors, the GeoSAR system can be calibrated. This calibration process yields the true position of the aircraft with an uncertainty of 20- 50 cm. This process thus allows an independent assessment of the accuracy of our GPS-based positioning systems. We will present an overview of the GeoSAR motion measurement system, focusing on the use of GPS and the blending of position data from the various systems. We will present the results of our calibration studies that relate to the accuracy the GPS positioning. We will discuss the effects these positioning, errors have on the resultant DEM products and imagery.
Author
Airborne Equipment; Global Positioning System; Kinematics; Mapping; Terrain; Synthetic Aperture Radar; Interferometry

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment. and microelectronics and integrated circuitry. For related information see also 60 Computer Operations and Hardware; and 76 Solid-State Physics. For communications equipment and devices see 32 Communications and Radar.

20000068440 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Shock Testing of: Two Switches, Type L1914 and L1920; An Emergency Switch, Type 704.064.2; A Rotary Switch, Type QM40; Two Wall Sockets, Type L1957 and L1960
vanBragt, F. J., Building and Construction Research TNO, Netherlands; Jul. 30, 1999; 34p; In English; Original contains color illustrations
Contract(s)/Grant(s): A99/KM/102; TNO Proj. 006.93292/01.01
Report No.(s): TD-99-0094; Rept-99-CMC-R042; Copyright; Avail: Issuing Activity

Shock tests have been performed on wall sockets and switches. The emergency switch did not meet the requirements due to separation of the contact block from the push button. Contact rumble was established with the rotary and emergency switch.
Author
Shock Tests; Switches; Walls

California Univ., Berkeley, CA USA

Nonlinear Dynamics for Communication Systems *Final Report, 2 Feb. 1997-31 Dec. 1999*

Chua, Leon O.; Apr. 25, 2000; 7p; In English

Contract(s)/Grant(s): N00014-97-1-0463

Report No.(s): AD-A376817; 442427-23088; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have successfully accomplished all the proposed tasks, and discovered and developed new results of fundamental significance and potential applications in the following areas: 1) robustness of chaotic synchronization schemes, 2) efficiency of chaotic synchronization systems, 3) design of practical chaotic spread-spectrum communication systems, 4) channel capacity of chaotic spread-spectrum communication systems, and 5) potential commercial applications of chaotic spread-spectrum communication systems.

DTIC

Nonlinear Systems; Telecommunication; Systems Engineering; Spread Spectrum Transmission

Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Frequency-Domain Analysis of Diffusion-Cooled Hot-Electron Bolometer Mixers

Skalare, A., Jet Propulsion Lab., California Inst. of Tech., USA; McGrath, W. R., Jet Propulsion Lab., California Inst. of Tech., USA; Bumble, B., Jet Propulsion Lab., California Inst. of Tech., USA; LeDuc, H. G., Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 13p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new theoretical model is introduced to describe heterodyne mixer conversion efficiency and noise (from thermal fluctuation effects) in diffusion-cooled superconducting hot-electron bolometers. The model takes into account the non-uniform internal electron temperature distribution generated by Wiedemann-Franz heat conduction, and accepts for input an arbitrary (analytical or experimental) superconducting resistance-versus- temperature curve. A non-linear large-signal solution is solved iteratively to calculate the temperature distribution, and a linear frequency-domain small-signal formulation is used to calculate conversion efficiency and noise. In the small-signal solution the device is discretized into segments, and matrix algebra is used to relate the heating modulation in the segments to temperature and resistance modulations. Matrix expressions are derived that allow single-sideband mixer conversion efficiency and coupled noise power to be directly calculated. The model accounts for self-heating and electrothermal feedback from the surrounding bias circuit.

Author

Frequency Domain Analysis; Conductive Heat Transfer; Bolometers; Hot Electrons; Energy Conversion Efficiency

Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Rotary Motors Actuated by Traveling Ultrasonic Flexural Waves

Bar–Cohen, Yoseph, Jet Propulsion Lab., California Inst. of Tech., USA; Bao, Xiaoqi, Jet Propulsion Lab., California Inst. of Tech., USA; Grandia, Willem, Quality Material Inspection, USA; [1999]; 7p; In English; 6th; 6th Annual International Symposium on Smart Structures and Materials, 1-5 Mar. 1999, Newport, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Efficient miniature actuators that are compact and consume low power are needed to drive space and planetary mechanisms in future NASA missions. Ultrasonic rotary motors have the potential to meet this NASA need and they are developed as actuators for miniature telerobotic applications. These motors have emerged in commercial products but they need to be adapted for operation at the harsh space environments that include cryogenic temperatures and vacuum and also require effective analytical tools for the design of efficient motors. A finite element analytical model was developed to examine the excitation of flexural plate wave traveling in a piezoelectrically actuated rotary motor. The model uses 3D finite element and equivalent circuit models that are applied to predict the excitation frequency and modal response of the stator. This model incorporates the details of the stator including the teeth, piezoelectric ceramic, geometry, bonding layer, etc. The theoretical predictions were corroborated experimentally for the stator. In parallel, efforts have been made to determine the thermal and vacuum performance of these motors. Experiments have shown that the motor can sustain at least 230 temperature cycles from 0 C to -90 C at 7 Torr pressure significant performance change. Also, in an earlier study the motor lasted over 334 hours at -150 C and vacuum. to explore telerobotic applications for USMs a robotic arm was constructed with such motors.

Author

Miniaturization; Actuators; Piezoelectric Ceramics; Mathematical Models; Cryogenic Temperature

National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Gaithersburg, MD USA

Electronics and Electrical Engineering Laboratory Strategic Plan for Fiscal Years 2000-2005

Feb. 2000; 28p; In English

Report No.(s): PB2000-101966; NISTIR-6472; No Copyright; Avail: National Technical Information Service (NTIS)

Partial Contents: Mission Statement; Assure Measurement Accuracy, Accessibility, and Applicability; Goals and Objectives; Strengthen Foundation for All Electrical Measurements; Provide Measurement Capability Required for a World-Class Electronics Industry Integration; Provide Measurement Capability Required for World-Class Electrical Industries; Provide Technical Support to Law Enforcement; Strategies; Resources; Communication, Accountability, and Other Factors; Factors Affecting Achievement; and Program Evaluation.

NTIS

Electrical Engineering; Electronic Equipment; Electrical Measurement

20000069370 National Inst. of Standards and Technology, Electricity Div., Gaithersburg, MD USA

Electronics and Electrical Engineering Laboratory: Electricity Division. Programs, Activities, and Accomplishments

Jan. 2000; 68p; In English

Report No.(s): PB2000-101326; NISTIR-6431; No Copyright; Avail: National Technical Information Service (NTIS)

The Electricity Division maintains and disseminates the national standards of electrical measurement and develops the measurement methods and services needed to support electrical materials, components, instruments, and systems used for the generation, transmission, and application of conducted electrical power. It also performs related activities in support of the electronics industry, including research on video technology and electronic product data exchange.

NTIS

Electrical Measurement; Electronic Equipment; Electrical Engineering; Electricity

20000069776 Research Inst. of National Defence, Div. of Defence Analysis, Stockholm, Sweden

Information Survey about DRFM Techniques *Informationsstudie om DREM-Teknik*

Christiansson, H.; Mar. 1999; 40p; In Swedish

Report No.(s): PB2000-103042; FOA-R-99-01094-170-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report compiles information about digital radio frequency memories (DRFM), that has been assembled from journals, databases and the Internet. The result is presented, using the headlines: Doctrine documents, Journals, Databases, Conferences, Companies and Product presentations, Contract proposals, News groups, Thesis, Courses and Universities.

NTIS

Surveys; Radio Frequencies

20000069785 Michigan Univ., Ann Arbor, MI USA

Measured Attenuation of Coplanar Waveguide on CMOS Grade Silicon Substrates with Polyimide Interface Layer

Ponchak, G. E., NASA Glenn Research Center, USA; Katehi, L. P. B., Michigan Univ., USA; Electronics Letters; [2000]; Volume 34, No. 13, pp. 1327-1329; In English

Contract(s)/Grant(s): RTOP 632-6E-51; Copyright; Avail: Issuing Activity

The measured propagation constant of a coplanar waveguide on CMOS grade silicon with a polyimide interface layer is presented, It is shown that the transmission line can have an attenuation comparable to other transmission lines on Si substrates if the proper polyimide thickness is used.

Author

Polyimides; Silicon; Substrates; Waveguides; Radio Attenuation; Integrated Circuits; Transmission Lines; Thin Films

20000069787 California Univ., Gigascale Silicon Research Center, Berkeley, CA USA

Gigascale Silicon Research Center for Design and Test *Annual Report, 191999*

Jan. 07, 2000; 65p; In English

Report No.(s): AD-A377260; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

It has been a very active year for the GSRC since we held our initial kickoff meeting in December 1998. The technical goals of the GSRC concern the development of algorithms, tools, and methodologies for increasing design productivity of reliable silicon-based electronic systems. However, of equal importance, the GSRC is an experiment in a new way of carrying out University/industry/Government-based collaborative research. It concerns the development of a national resource--a community of researchers, from universities, industry, and government agencies, developing a compelling, long-range research vision and working together to see that vision transformed into a reality. to that end, our primary goal for this first year has been to establish such a shared understanding of the long-range issues facing the development of semiconductors and the systems they enable, to

develop the infrastructure and behaviors needed to enable close collaboration, and to understand the fundamental issues that limit our abilities to improve designer productivity.
DTIC

Silicon; Electronic Equipment; Performance Tests; Systems Engineering; Semiconductors (Materials)

20000069856 California Univ., Dept. of Computer Engineering, Santa Barbara, CA USA

Instrumentation for High Performance Highly Parallel WDM and SCM Switching, Processing and Communications *Final Report, 1 May 1998-30 Apr 1999*

Blumenthal, Daniel J.; Apr. 1999; 16p; In English

Contract(s)/Grant(s): FA9620-98-1-0404; AF Proj. 3484

Report No.(s): AD-A377829; AFRL-SR-BL-TR-00-0791; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The acquired equipment was used for the following research projects: (1) Broadband Optically Pre-amplified Receiver using and Interferometric Wavelength Converter; (2) WDM Optical IP Tag Switching with Packet-Rate Wavelength Conversion and Subcarrier Multiplexed Addressing; (3) Four Channel MMIC-based Transmitter Module for RF/Optical Subcarrier Multiplexed Communications; and (4) Optical Network Channel Protection Switching Demonstration using a Bi-Directional Reconfigurable Multichannel Add/Drop Multiplexer.
DTIC

Preamplifiers; Optical Switching; Optical Communication; Channels (Data Transmission); Integrated Circuits

20000069861 Army Research Lab., Sensors Directorate, Adelphi, MD USA

Compact Impulse Source for Wideband Signal Calibrations and General Laboratory Use*, Jan.-Jul. 1999*

Litz, Marc S.; Judy, Daniel C.; Weidenheimer, Doug M.; Jenkins, Bruce; Apr. 2000; 16p; In English

Report No.(s): AD-A377611; ARL-TR-2117; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A compact impulse generator has been designed and built for use in calibrating wideband signal hardware components. Operating modes include single shot to 10-Hz repetition rate. The voltage output is variable from 0 to 1000 V. The pulsewidth is fixed at 5 ns with an 110-ps rise time. The source may be operated on battery power or with a wall plug. The design parameters and measured output characteristics are documented in this report. The waveform is shown to be very repeatable, which makes it useful as a wideband calibration source.
DTIC

Broadband; Impulse Generators; Waveforms; Pulse Generators

20000069865 Fisk Univ., Nashville, TN USA

Growth and Characterization of Doped CdSSe and CdSeTe for Opto-Electronic Applications *Final Report, 1 Feb. 1996-1 Feb. 1999*

Burger, Arnold; Morgan, Steven H.; Jul. 1999; 11p; In English

Contract(s)/Grant(s): F33615-96-C-5451; AF Proj. 4348

Report No.(s): AD-A377629; AFRL-ML-WP-TR-1999-4141; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Control over composition and basic properties of semiconductors is extremely important for the fabrication of efficient and reliable devices. Both macroscopic and microscopic properties of materials strongly depend on their structure. The goal of this three-year project was to establish a collaborative research effort between Fisk University and the Air Force Research Laboratory, aimed at the preparation and optical characterization of doped CdSSe and CdSeTe for their use in opto-electronic applications. The approach involved the preparation of novel crystals followed by investigation of the basic optical and electro-optical properties of the Cd-based ternary compounds. Optical properties were characterized using UV-visible-NIR spectroscopy and infrared spectroscopy, and photorefractive properties were measured using conventional wave-mixing techniques. Defect and transport properties were characterized by photo luminescence and optical absorbance spectroscopies. The achievements under this program led to improvements in the understanding of interactions between material defect properties of II-VI semiconductor crystals and the photorefractive response and other optical properties. This understanding will allow tailoring these defect properties in order to optimize the material for specific applications.
DTIC

Doped Crystals; Electro-Optics; Optical Properties; Semiconductors (Materials); Crystal Optics; Crystal Structure; Crystal Growth

20000070361 NASA Ames Research Center, Moffett Field, CA USA

Formal Verification of a Power Controller Using the Real-Time Model Checker UPPAAL

Havelund, Klaus, NASA Ames Research Center, USA; Larsen, Kim Guldstrand, Aalborg Univ., Denmark; Skou, Arne, Aalborg Univ., Denmark; [1999]; 22p; In English; Formal Methods for Real-Time and Probabilistic Systems, 26-28 May 1999, Bamberg, Germany; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A real-time system for power-down control in audio/video components is modeled and verified using the real-time model checker UPPAAL. The system is supposed to reside in an audio/video component and control (read from and write to) links to neighbor audio/video components such as TV, VCR and remote-control. In particular, the system is responsible for the powering up and down of the component in between the arrival of data, and in order to do so in a safe way without loss of data, it is essential that no link interrupts are lost. Hence, a component system is a multitasking system with hard real-time requirements, and we present techniques for modeling time consumption in such a multitasked, prioritized system. The work has been carried out in a collaboration between Aalborg University and the audio/video company B&O. by modeling the system, 3 design errors were identified and corrected, and the following verification confirmed the validity of the design but also revealed the necessity for an upper limit of the interrupt frequency. The resulting design has been implemented and it is going to be incorporated as part of a new product line.

Author

Program Verification (Computers); Proving; Controllers; Electronic Control; Control Systems Design

20000070424 Texas Univ., Inst. for Advanced Technology, Austin, TX USA

Preliminary Study into the Magnetically Assisted Blocking of Reverse Current in a Cold Cathode High Current Vacuum Switch*, Jun. - Dec. 1998*

Bower, S.; Cook, K. G.; Jones, F. J.; Pirrie, C. A.; Jul. 1999; 12p; In English

Contract(s)/Grant(s): DAAA21-93-C-0101

Report No.(s): AD-A368331; IATR-0213; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The feasibility of using an external magnetic field to cause the blocking of reverse conduction in a vacuum switch was investigated. The design and build of a test switch was followed by a program of experimental work during which magnetic fields were applied to the switch to attempt to interrupt the current at the first zero crossing of an oscillatory waveform. The design, build and operation of the switch is described and the results of the experimental work outlined. The results show that an effect; which falls short of complete interruption, could be reproducibly observed and that the magnitude of the effect depended upon the position in time of the applied field relative to the current zero crossing point. A number of observations made during the work have indicated possible methods of improving the reverse blocking performance and these will be outlined in addition to general conclusions.

DTIC

Switches; Electric Current; Cold Cathode Tubes; Interruption

20000070426 National Defence Research Establishment, Dept. of Command and Control Warfare Technology, Linkoeping, Sweden

Description of the Chaff Model REMJA 2 in ACSL *Beskrivning av Remsmodellen REMJA II i ACSL*

Bergstroem, L.; Jun. 1999; 32p; In Swedish

Report No.(s): PB2000-103089; FOA-R-99-01150-616-SE; No Copyright; Avail: National Technical Information Service (NTIS)

REMJA II is a model for simulation of chaff dispensing from an aircraft. The model is built in ACSL/GM (Advanced Continuous Simulation Language/Graphic Modeller) and it is a development of the model REMJA I which is written in MATLAB. In this model up to four different chaff dispensers can be located on the aircraft and four types of chaff payloads with different characteristics can be used. The chaff characteristics are defined by ten input parameters which determine the RCS (Radar Cross Section) bloom rate and the way of motion. The movement is composed of a short turbulent phase followed by a retardation in the forward direction and a simultaneous perpendicular circular rotation. Both the number of chaff dispensers and types of chaff payloads can be increased in the model if required.

NTIS

Chaff; Simulation; Models; Turbulence; Payloads

20000070475 Nanyang Technological Univ., Nanyang, Singapore

Photonics Technology into the 21st Century: Semiconductors, Microstructures, and Nanostructures Volume 3899

Ho, Seng T., Nanyang Technological Univ., Singapore; Zhou, Yan, Nanyang Technological Univ., Singapore; Chow, Weng W.,

Nanyang Technological Univ., Singapore; Arakawa, Yasuhiko, Nanyang Technological Univ., Singapore; Dec. 1999; Volume 3899; 564p; In English, 1-3 Dec. 1999, Singapore; Sponsored by International Society for Optical Engineering, USA
Report No.(s): AD-A377706; No Copyright; Avail: CASI; A04, Microfiche; A24, Hardcopy

The proceedings from the Photonics Technology into the 21st Century: Semiconductors, Microstructures, and Nanostructures is presented.
DTIC
Microstructure; Nanostructures (Devices); Photonics; Semiconductors (Materials); Conferences

20000070479 Nanyang Technological Inst., Singapore
**Design, Fabrication, and Characterization of Photonic Devices*, 30 Nov.-3 Dec. 1999*
Osinski, Marek, Nanyang Technological Inst., Singapore; Chua, Soo J., Nanyang Technological Inst., Singapore; Chichibu, Shigefusa F., Nanyang Technological Inst., Singapore; Dec. 03, 1999; 787p; In English; Photonics and Applications (ISPA'99), 30 Nov. - 3 Dec. 1999, Singapore; Sponsored by International Society for Optical Engineering, USA
Contract(s)/Grant(s): F6256200M9015
Report No.(s): AD-A377776; AOARD-CSP-991014; No Copyright; Avail: CASI; A10, Microfiche; A99, Hardcopy

Future technology and business opportunities in photonics: a view from the Optoelectronics Industry Development Association (OIDA), Oxide-confined vertical-cavity surface-emitting lasers, quantum dots, and the Purcell effect: can scaling the mode size improve laser performance?, Optical nonlinearities in semiconductors, Recent progress of photonic device research, Measurement of mounting-induced strain in high-power laser diode arrays (Invited Paper) Fabrication and characterization of high-power diode lasers, Stimulated emission and pump-probe studies of wide-gap nitrides for UV-blue photonic applications (Invited Paper), Optical properties of InGaN grown by MOCVD on sapphire and on bulk GaN, Comparison of optical properties of GaN and InGaN quantum,well structures, and Low-cost synthesis of ZnCdSe semiconducting thin films for optoelectronic applications.
DTIC
Electro-Optics; High Power Lasers; Optical Properties; Quantum Dots; Semiconducting Films; Photonics

20000070494 Army Research Lab., Sensors Directorate, Adelphi, MD USA
**Response Characteristics of Active Scattering Aerosol Spectrometer Probes Made by Particle Measuring Systems*, Jun.-Dec. 1998*
Pinnick, Ronald G.; Pendleton, J. D.; Videen, Gorden; Mar. 2000; 49p; In English
Report No.(s): AD-A376912; ARL-TR-1973; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Predictions are reported of the size response of various light-scattering aerosol counters manufactured by Particle Measuring Systems. Models considered are those that exploit the high intensity of light available within the cavity of a HeNe gas laser (generically referred to by the manufacturer as "active scattering aerosol spectrometer probes"). The new response function properly averages over particle trajectories through nodes, antinodes, and intermediate regions of the intracavity laser beam. Our studies address probes having two basic scattering geometries: those that collect light scattered over a relatively narrow solid angle (subtending angles between 4 and 22 degrees from the laser beam axis) and those that collect light over a rather large solid angle (between 35 and 120 degrees). The new response function predicts smoother dependence on particle size than the previous response function of Pinnick and Auvermaun (1979, J. Aerosol Sci. 10: 55-74) and is in better agreement with measurement. Response calculations for common atmospheric aerosol (water, sulfuric acid, ammonium sulfate, and black carbon) reveal the considerable sensitivity of the response to particle dielectric properties. Comparison of response calculations with the manufacturer's calibration reveals conditions for which the manufacturer's calibration is most appropriate, and the potential for errors (as much as a factor of two in sizing) when it is blindly applied. These results should help the user of these instruments to more realistically interpret size distribution measurements.
DTIC
Aerosols; Spectrometers; Light Scattering; Radiation Counters; Laser Beams; Size Distribution; Laser Applications

20000070495 California Univ., Dept. of Applied Sciences, Davis, CA USA
**High Performance Gyroklystron Amplifier *Final Report, 1 Jul. 1995-30 Jun. 1999*
Luhmann, N. C., Jr; Apr. 24, 2000; 8p; In English
Contract(s)/Grant(s): F49620-95-1-0458; AF Proj. 3484
Report No.(s): AD-A376903; AFRL-SR-BL-TR-00-0168; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this AASERT project, basic studies were performed to provide the understanding for higher performance gyroklystrons and an attempt was made to improve the performance of Varian/CPI's pioneering gyroklystron amplifier, which encountered significant oscillation problems.

DTIC

Cyclotron Resonance Devices; Klystrons

20000070726 NASA Goddard Space Flight Center, Greenbelt, MD USA

Thermal Characterization for a Modular 3-D Multichip Module

Fan, Mark S., NASA Goddard Space Flight Center, USA; Plante, Jeannette, NASA Goddard Space Flight Center, USA; Shaw, Harry, NASA Goddard Space Flight Center, USA; May 18, 2000; 7p; In English; I-Therm 2000, 23-26 May 2000, Las Vegas, NV, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

NASA Goddard Space Flight Center has designed a high-density modular 3-D multichip module (MCM) for future space-flight use. This MCM features a complete modular structure, i.e., each stack can be removed from the package without damaging the structure. The interconnection to the PCB is through the Column Grid Array (CGA) technology. Because of its high-density nature, large power dissipation from multiple layers of circuitry is anticipated and CVD diamond films are used in the assembly for heat conduction enhancement. Since each stacked layer dissipates certain amount of heat, designing effective heat conduction paths through each stack and balancing the heat dissipation within each stack for optimal thermal performance become a challenging task. To effectively remove the dissipated heat from the package, extensive thermal analysis has been performed with finite element methods. Through these analyses, we are able to improve the thermal design and increase the total wattage of the package for maximum electrical performance. This paper provides details on the design-oriented thermal analysis and performance enhancement. It also addresses issues relating to contact thermal resistance between the diamond film and the metallic heat conduction paths.

Author

Thermal Analysis; Temperature Effects; Three Dimensional Models; Chips (Electronics); Fabrication; Design Analysis; Performance Tests; Conductive Heat Transfer

20000070757 State Univ. of New York, Buffalo, NY USA

Development of Measurement Capability for Micro-Vibration Evaluations with Application to Chip Fabrication Facilities

Lee, G. C.; Liang, Z.; Song, J. W.; Shen, J. D.; Liu, W. C.; Dec. 01, 1999; 150p; In English

Contract(s)/Grant(s): NSF CMS-97-01471

Report No.(s): PB2000-105993; MCEER-99-0020; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

This report summarizes a study to measure micro-vibrations of ground motions at a proposed site to fabricate electronic IC chips. Current guidelines for semi-conductor fabrication facilities recommend that they be subjected to less than 100 micro-inches per second RMS (root-mean-square) velocity in every on-third octave frequency band with a preferred range of 60 to 70 micro-inches per second. The site under study is located near a major express way, a train thorough fare, and an active mining operation. The report also introduces the theoretical development for the relationship between frequency spectra and RMS values, which can be adopted for a wide range of applications on interpretations of the data obtained from up-to-date data acquisition systems.

NTIS

Industrial Plants; Integrated Circuits; Earthquake Resistant Structures; Vibration Measurement; Frequency Response; Fabrication

20000070848 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Flexible All-Digital Receiver for Bandwidth Efficient Modulations

Gray, Andrew, Jet Propulsion Lab., California Inst. of Tech., USA; Srinivasan, Meera, Jet Propulsion Lab., California Inst. of Tech., USA; Simon, Marvin, Jet Propulsion Lab., California Inst. of Tech., USA; Yan, Tsun–Yee, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An all-digital high data rate parallel receiver architecture developed jointly by Goddard Space Flight Center and the Jet Propulsion Laboratory is presented. This receiver utilizes only a small number of high speed components along with a majority of lower speed components operating in a parallel frequency domain structure implementable in CMOS, and can currently process up to 600 Mbps with standard QPSK modulation. Performance results for this receiver for bandwidth efficient QPSK modulation

schemes such as square-root raised cosine pulse shaped QPSK and Feher's patented QPSK are presented, demonstrating the flexibility of the receiver architecture.
Author
Bandwidth; Digital Systems; Modulation; Transmitter Receivers; Quadrature Phase Shift Keying; Parallel Processing (Computers); Architecture (Computers)

20000070851 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Recent Developments in the Analysis of Couple Oscillator Arrays
Pogorzelski, Ronald J., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 35p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    This presentation considers linear arrays of coupled oscillators. Our purpose in coupling oscillators together is to achieve high radiated power through the spatial power combining which results when the oscillators are injection locked to each other. York, et. al. have shown that, left to themselves, the ensemble of injection locked oscillators oscillate at the average of the tuning frequencies of all the oscillators. Coupling these arrays achieves high radiated power through coherent spatial power combining. The coupled oscillators are usually designed to produce constant aperture phase. Oscillators are injection locked to each other or to a master oscillator to produce coherent radiation. Oscillators do not necessarily oscillate at their tuning frequency.
CASI
Linear Arrays; Oscillators; Coupled Modes; Coupling; Boundary Conditions; Diffusion Theory; Beam Steering

20000072425 International Society for Optical Engineering, Bellingham, WA USA
Advanced Photonic Sensors and Applications
Lieberman, Robert A.; Asundi, Anand K.; Asanuma, Hiroshi; Dec. 1999; ISSN 0277-786X; Volume 3897; 789p; In English, 30 Nov. - 3 Dec. 1999, Singapore; Sponsored by International Society for Optical Engineering, USA
Report No.(s): AD-A377883; ISBN 0-8194-3499-X; No Copyright; Avail: CASI; A10, Microfiche; A99, Hardcopy
    The proceeding volume contains oral and poster contributions from a symposium on "Advanced Photonic Sensors and Applications" at the SPIE-The International Society for Optical Engineering Nanyang Technological University, Singapore from 30 November to 3 December 1999. The volume comprises the area of electrooptical materials and photonic sensors design and fabrication. The symposium also focuses on advances in biomedical and biochemical sensors technology. Studies in microoptical metrology and vibration sensors are greatly highlighted and in detail discussed.
DTIC
Sensors; Conferences; Nonlinear Optics; Photonics; Fabrication

20000072431 Aerospace Corp., Lab. Operations, El Segundo, CA USA
Correlation of Picosecond Laser-Induced Latchup and Energetic Particle-Induced Latchup in CMOS Test Structures
Moss, S. C.; Lalumondiere, S. D.; Scarpulla, J. R.; MacWilliams, K. P.; Crain, W. R.; Mar. 15, 2000; 22p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A377659; TR-95(5925)-6; SMC-TR-00-09; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    We show that the thresholds for picosecond (psec) laser pulse-induced latchup and energetic particle-induced latchup are well correlated over a range of bulk CMOS test structures designed to be susceptible to latchup. The spatial length of the latchup-sensitive node of the test structures covers a range of values that commonly occur in bulk CMOS devices. The accuracy of this correlation implies that laser-induced latchup can be used for hardness assurance and, under the proper conditions, can be an accurate predictor of latchup threshold linear energy transfer (LET) for most bulk CMOS devices.
DTIC
Picosecond Pulses; Laser Outputs; CMOS; Laser Applications; Latch-Up

20000072491 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Technical Challenges in Reliable Microelectronics Packaging of Microelectromechanical Systems (MEMS) for Space Applications
Ramesham, Rajeshuni, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only
    MEMS have shown a significant promise in the last decade for a variety of applications such as air-bag, pressure sensors, accelerometer, microgyro, chemical sensors, artificial nose, etc. Standard semiconductor microelectronics packaging needs the integrated circuits (IC) to be protected from the harsh environment, and provide electrical communication with the other parts of the circuit, facilitate thermal dissipation efficiently, and impart mechanical strength to the silicon die. Microelectronics pack-

aging involves wafer dicing, bonding, lead attachment, encapsulation to protect from the environment, electrical integrity, and package leak tests to assure the reliable IC packaging technology. Active elements or microstructures in MEMS devices often interfaces with the hostile environment where packaging leak tests and testing of such devices using chemical and mechanical parameters will be very difficult and expensive. Packaging of MEMS is significantly complex as they serve to protect from the environment and microstructures interact with the same environment to measure or affect the desired physical or chemical parameters. The most of the silicon circuitry is sensitive to temperature, moisture, magnetic field, light, and electromagnetic interference. The package must then protect the on-board silicon circuitry while simultaneously exposing the microsensor to the effect it measures to assure the packaging technology of MEMS. MEMS technology has a major application in developing a microspacecraft for space systems provided reliability of MEMS packaging technology is sufficiently addressed. This MEMS technology would eventually miniaturize many of the components of the spacecraft to reach the NASA's goal by building faster, cheaper, better, smaller spacecraft to explore the space more effectively. This paper discusses the latest developments in the MEMS technology and challenging technical issues in the packaging of hermetically sealed and non-hermetically sealed MEMS sensor devices for microspacecraft applications.

Author

Aerospace Systems; Microelectromechanical Systems; Microelectronics; Reliability; Electronic Packaging

20000072580 NASA Lewis Research Center, Cleveland, OH USA

Introduction to the Special Issue on Microwave Circuits on Silicon Substrates

Luy, Johann–Friedrich, Editor, Daimler-Benz Research, Germany; Ponchak, George E., Editor, NASA Lewis Research Center, USA; IEEE Transactions on Microwave Theory and Techniques; May 1998; ISSN 0018-9480; Volume 46, No. 5, pp. 569-571; In English

Contract(s)/Grant(s): RTOP 632-6E-51; Copyright; Avail: Issuing Activity

This article discusses the development of microwave circuits on silicon substrate. Silicon, even though inexpensive, did not provide the performance required for microwave circuits. Instead the development of microwave circuits used GaAs and InP substrates. With the development of commercial usages for microwave circuits, the costs of microwave circuits became an issue. The importance of cost, and the development of Si-device capabilities and fabrication techniques, such as molecular beam epitaxy, and ultra-high chemical vapor deposition. provided the circumstances where the development of microwave circuits on silicon is now possible.

CASI

Fabrication; Microwave Circuits; Silicon; Substrates

20000073313 Army Construction Engineering Research Lab., Champaign, IL USA

Bus Current Feedback for Motor Control *Final Report*

Maase, Hannon T.; Locker, Jonathan A.; Krein, Philip T.; Jan. 2000; 23p; In English

Report No.(s): AD-A377502; CERL-TR-00-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many algorithms using nonlinear control ideas have been applied to the induction motor control problem to allow the user to control the torque, speed, or position response of a closed loop servo quite precisely. For many applications, the incremental improvement in transient torque, speed, or position response does not justify the additional computational requirements or a complicated tuning and commissioning process. A better solution would be to improve the utility of existing algorithms that may normally exhibit lower performance, but that can be extended easily. One such extension involves the use of the DC link current as a control variable in various motor control algorithms. This work examined the use of such a variable as an enhancement for scalar and vector control algorithms for the induction motor and discussed the effects of such a control on the operation of an electric vehicle.

DTIC

Direct Current; Induction Motors; Nonlinear Systems; Algorithms; Feedback Control; Electric Propulsion; Directional Control; Servomechanisms

20000073714 Naval Postgraduate School, Monterey, CA USA

Transient Field Visualization for Ultra-Wideband Antenna Design

Adamiak, David V.; Dec. 1999; 145p; In English

Report No.(s): AD-A374319; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Impulse antennas are specifically designed to transmit and/or receive very short bursts of electromagnetic energy. by their very nature, these short time-duration bursts (impulses) require ultra-wideband transmitting and receiving antennas. This thesis investigates a number of UWB antenna designs to determine their feasibility in receiving an impulse having a 1000:1 bandwidth

(10 MHz to 10 GHz) with virtually no distortion. As a tool in aiding the design of such an antenna, this thesis presents original software that was developed to visualize an impulse propagating in the near-field region of the antenna being considered. Such software will significantly reduce the workload and time required for antenna design and provide unique capabilities for heuristic understanding of the physics involved.
DTIC
Antenna Design; Broadband; Transmission; Heuristic Methods

20000073717 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Precise Frequency Measurements Using a Superconducting Cavity Stabilized Oscillator
Strayer, D. M., Jet Propulsion Lab., California Inst. of Tech., USA; Yeh, N.–C., California Inst. of Tech., USA; Jiang, W., California Inst. of Tech., USA; Anderson, V. L., California Inst. of Tech., USA; Asplund, N., California Inst. of Tech., USA; [1999]; 1p; In English, 20-26 Mar. 1999, Atlanta, GA, USA; Sponsored by American Physical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Many physics experiments call on improved resolution to better define the experimental results, thus improving tests of theories. Modern microwave technology combined with high-Q resonators can achieve frequency readout and control with resolutions up to a part in 10(exp 18). When the physical quantity in question in the experiment can be converted to a frequency or a change in frequency, a high-stability microwave oscillator can be applied to obtain state-of-the-art precision. In this work we describe the overall physical concepts and the required experimental procedures for optimizing a high-resolution frequency measurement system that employs a high-Q superconducting microwave cavity and a low-noise frequency synthesizer. The basic approach is to resolve the resonant frequencies of a high-Q (Q is greater than 10(exp 10)) cavity to extremely high precision (one part in 10(exp 17)- 10(exp 18)). Techniques for locking the synthesizer frequency to a resonant frequency of the superconducting cavity to form an ultra-stable oscillator are described. We have recently set up an ultra-high-vacuum high-temperature annealing system to process superconducting niobium cavities, and have been able to consistently achieve Q is greater than 10(exp 9). We have integrated high-Q superconducting cavities with a low-noise microwave synthesizer in a phase-locked-loop to verify the frequency stability of the system. Effects that disturb the cavity resonant frequency (such as the temperature fluctuations and mechanical vibrations) and methods to mitigate those effects are also considered. Applicability of these techniques to experiments will be discussed, and our latest experimental progress in achieving high-resolution frequency measurements using the superconducting-cavity-stabilized-oscillator will be presented.
Author
High Resolution; Frequency Measurement; Frequency Shift; Frequency Stability; Stable Oscillations; Frequency Synthesizers; Microwave Oscillators; Q Factors; Resonant Frequencies

20000073724 Department of Defense, Office of the Inspector General, Arlington, VA USA
BA-5598 Lithium Sulfur Dioxide and the BA-4386 Magnesium Batteries
Jun. 18, 1993; 68p; In English
Report No.(s): AD-A376753; IG/DOD-93-115; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Army Communications-Electronics Command (CECOM) is responsible for the supply management of batteries used in communications-electronics equipment for all Services. An inquiry was received from the Chairman of the House Armed Services Committee questioning the quantity of BA-5598 lithium batteries being procured by CECOM.
DTIC
Lithium Sulfur Batteries; Magnesium Cells; Performance Tests; Component Reliability

20000073743 Centre National de la Recherche Scientifique, Toulouse, France
On-state electrothermal modelling of large area power components and multi-chip power modules
Bellil, K.; Tounsi, P.; Dorkel, J. M.; Leturcq, P.; May 31, 1997; 7p; In English
Report No.(s): DE99-723887; CNRS-LAAS-97164; No Copyright; Avail: Department of Energy Information Bridge

A tool aimed at the accurate computation of the interactive temperature and power dissipation distributions over the active area of power components or modules, is presented. The temperature distribution over the whole active area is computed taking into consideration the 3D heat transfer in the package. A procedure is added in order to compute the distribution of the electrical dissipation resulting from electrothermal interaction under the assumption of an imposed on-state current. The tool allows to investigate for the upper limit of the on-state current in the device as well as for the impact on power dissipation of some influential thermal parameters such as thermal resistances of the die bonding: examples of a large IGBT chip and a MOS power module, are given.
NTIS
Power Conditioning; Dissipation

20000073744 Centre National de la Recherche Scientifique, Toulouse, France

Thick soi films by rapid thermal processing for high voltage integrated circuits

Dilhac, J. M.; Cornibert, L.; Charitat, G.; Nolhier, N.; Zerrouk, D.; May 31, 1997; 8p; In English

Report No.(s): DE99-723886; CNRS-LAAS-97163; No Copyright; Avail: Department of Energy Information Bridge

A structure for electrical insulation of control devices used in high voltage integrated circuits, is presented, combining junction and dielectric insulation for vertical and lateral insulation respectively. The insulation performances are first theoretically assessed to estimate the required oxide thickness; then, a method for creating the buried oxide layer is presented and experimentally verified; the method consists in re-crystallizing thick polysilicon films by Lateral Epitaxial Growth over Oxide (LEGO) in order to fabricate substrates with localized SOI (silicon on insulator) layers, and avoids any horizontal thermal gradient in the solid phase and therefore produces less defects, while allowing the formation of much thicker films than in any other melt-based technique.
NTIS

Thick Films; Electrical Insulation; Control Equipment

20000073745 Centre National de la Recherche Scientifique, Toulouse, France

Power mos devices: structures and modelling procedures

Rossel, P.; Charitat, G.; Tranduc, H.; Morancho, F.; Moncoqut,; May 31, 1997; 18p; In English

Report No.(s): DE99-723885; CNRS-LAAS-97160; No Copyright; Avail: Department of Energy Information Bridge

In this survey, the historical evolution of power MOS transistor structures is presented and currently used devices are described. General considerations on current and voltage capabilities are discussed and configurations of popular structures are given. A synthesis of different modelling approaches proposed last three years is then presented, including analytical solutions, for basic electrical parameters such as threshold voltage, on-resistance, saturation and quasi-saturation effects, temperature influence and voltage handling capability. The numerical solutions of basic semiconductor devices is then briefly reviewed along with some typical problems which can be solved this way. A compact circuit modelling method is finally explained with emphasis on dynamic behavior modelling.
NTIS

Transistors; Voltage Regulators; Threshold Voltage

20000073746 Centre National de la Recherche Scientifique, Toulouse, France

Analytical model for the optimization of the turn-off performance of a self-firing mos-thyristor devise

Breil, M.; Sanchez, J. L.; May 31, 1997; 9p; In English

Report No.(s): DE99-723884; CNRS-LAAS-97152; No Copyright; Avail: Department of Energy Information Bridge

Spontaneously-fired and controlled turn-off MOS-thyristor device associations based on the concept of functional integration are very well-suited to Zero Voltage Switching applications. In this paper, an analytical model describing the turn-off operation and parasitic latch-up of a four-layered structure is presented. This model allows to highlight and optimize the most important device parameters (such as cathode length and surface concentration in the P region) acting upon the turn-off performance. 2D simulations using the PISCES code are implemented in order to verify the validity of this model
NTIS

Thyristors; Electronic Equipment

20000074065 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Adaptive Mesh Refinement for Microelectronic Device Design

Cwik, Tom, Jet Propulsion Lab., California Inst. of Tech., USA; Lou, John, Jet Propulsion Lab., California Inst. of Tech., USA; Norton, Charles, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Finite element and finite volume methods are used in a variety of design simulations when it is necessary to compute fields throughout regions that contain varying materials or geometry. Convergence of the simulation can be assessed by uniformly increasing the mesh density until an observable quantity stabilizes. Depending on the electrical size of the problem, uniform refinement of the mesh may be computationally infeasible due to memory limitations. Similarly, depending on the geometric complexity of the object being modeled, uniform refinement can be inefficient since regions that do not need refinement add to the computational expense. In either case, convergence to the correct (measured) solution is not guaranteed. Adaptive mesh refinement methods attempt to selectively refine the region of the mesh that is estimated to contain proportionally higher solution errors. The refinement may be obtained by decreasing the element size (h-refinement), by increasing the order of the element (p-refinement) or by a combination of the two (h-p refinement). A successful adaptive strategy refines the mesh to produce an accurate solution measured against the correct fields without undue computational expense. This is accomplished by the use of a) reliable

a posteriori error estimates, b) hierarchal elements, and c) automatic adaptive mesh generation. Adaptive methods are also useful when problems with multi-scale field variations are encountered. These occur in active electronic devices that have thin doped layers and also when mixed physics is used in the calculation. The mesh needs to be fine at and near the thin layer to capture rapid field or charge variations, but can coarsen away from these layers where field variations smoothen and charge densities are uniform. This poster will present an adaptive mesh refinement package that runs on parallel computers and is applied to specific microelectronic device simulations. Passive sensors that operate in the infrared portion of the spectrum as well as active device simulations that model charge transport and Maxwell's equations will be presented.
Author
Microelectronics; Refining; Finite Volume Method; Design Analysis; Computerized Simulation; Computational Grids

20000074069 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Stability and Phase Noise Tests of Two Cryo-Cooled Sapphire Oscillators
Dick, G. John, Jet Propulsion Lab., California Inst. of Tech., USA; Wang, Rabi T., Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A cryocooled Compensated Sapphire Oscillator (CSO), developed for the Cassini Ka-band Radio Science experiment, and operating in the 8K - 10K temperature range was previously demonstrated to show ultra-high stability of sigma(sub y) = 2.5 x 10 (exp -15) for measuring times 200 seconds less than or equal to tau less than or equal to 600 seconds using a hydrogen maser as reference. We present here test results for a second unit which allows CSO short-term stability and phase noise to be measured for the first time. Also included are design details of a new RF receiver and an intercomparison with the first CSO unit. Cryogenic oscillators operating below about 10K offer the highest possible short term stability of any frequency sources. However, their use has so far been restricted to research environments due to the limited operating periods associated with liquid helium consumption. The cryocooled CSO is being built in support of the Cassini Ka-band Radio Science experiment and is designed to operate continuously for periods of a year or more. Performance targets are a stability of 3-4 x 10 (exp -15) (1 second less than or equal to tau less than or equal to 100 seconds) and phase noise of -73dB/Hz @ 1Hz measured at 34 GHz. Installation in 5 stations of NASA's deep space network (DSN) is planned in the years 2000 - 2002. In the previous tests, actual stability of the CSO for measuring times tau less than or equal to 200 seconds could not be directly measured, being masked by short-term fluctuations of the H-maser reference. Excellent short-term performance, however, could be inferred by the success of an application of the CSO as local oscillator (L.O.) to the JPL LITS passive atomic standard, where medium-term stability showed no degradation due to L.O. instabilities at a level of (sigma)y = 3 x 10 (exp -14)/square root of tau. A second CSO has now been constructed, and all cryogenic aspects have been verified, including a resonator turn-over temperature of 7.907 K, and Q of 7.4 x 10 (exp 8). These values compare to a turn-over of 8.821 K and Q of 1.0 x 10 (exp 9) for the first resonator. Operation of this second unit provides a capability to directly verify for the first time the short-term (1 second less than or equal to tau less than or equal to 200 seconds) stability and the phase noise of the CSO units. The RF receiver used in earlier tests was sufficient to meet Cassini requirements for tau greater than or equal to 10 seconds but had short-term stability limited to 2-4 x 10 (exp -14) at tau = 1 second, a value 10 times too high to meet our requirements. A new low-noise receiver has been designed to provide approximately equal to 10-15 performance at 1 second, and one receiver is now operational, demonstrating again short-term CSO performance with H maser-limited stability. Short-term performance was degraded in the old receiver due to insufficient tuning bandwidth in a 100MHZ quartz VCO that was frequency-locked to the cryogenic sapphire resonator. The new receivers are designed for sufficient bandwidth, loop gain and low noise to achieve the required performance.
Author
Oscillators; Stability; Cryogenic Cooling; Noise Measurement; Sapphire

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FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also 02 Aerodynamics.

20000068997 Mississippi State Univ., Computational Fluid Dynamics Lab., Mississippi State, MS USA
Three-Dimensional Incompressible Navier-Stokes Flow Computations about Complete Configurations Using a Multi-block Unstructured Grid Approach
Sheng, Chunhua, Mississippi State Univ., USA; Hyams, Daniel G., Mississippi State Univ., USA; Sreenivas, Kidambi, Mississippi State Univ., USA; Gaither, J. Adam, Mississippi State Univ., USA; Marcum, David L., Mississippi State Univ., USA; Whitfield, David L., Mississippi State Univ., USA; July 2000; 11p; In English
Contract(s)/Grant(s): NAG1-1990

Report No.(s): MSSU-COE-ERC-00-07; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A multiblock unstructured grid approach is presented for solving three-dimensional incompressible inviscid and viscous turbulent flows about complete configurations. The artificial compressibility form of the governing equations is solved by a node-based, finite volume implicit scheme which uses a backward Euler time discretization. Point Gauss-Seidel relaxations are used to solve the linear system of equations at each time step. This work employs a multiblock strategy to the solution procedure, which greatly improves the efficiency of the algorithm by significantly reducing the memory requirements by a factor of 5 over the single-grid algorithm while maintaining a similar convergence behavior. The numerical accuracy of solutions is assessed by comparing with the experimental data for a submarine with stem appendages and a high-lift configuration.
Author

Three Dimensional Flow; Incompressible Flow; Navier-Stokes Equation; Computational Fluid Dynamics; Multiblock Grids

20000068998 MRJ Technology Solutions, Moffett Field, CA USA

Visualization, Extraction and Quantification of Discontinuities in Compressible Flows

Samtaney, Ravi, MRJ Technology Solutions, USA; Morris, R. D., MRJ Technology Solutions, USA; Cheeseman, P., MRJ Technology Solutions, USA; Sunelyansky, V., MRJ Technology Solutions, USA; Maluf, D., MRJ Technology Solutions, USA; Wolf, D., MRJ Technology Solutions, USA; [2000]; 9p; In English; International Conference on Computer Vision and Pattern Recognition, Jun. 2000, Hilton Head Island, SC, USA
Contract(s)/Grant(s): NAS2-14217; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Scientific visualizations of two-dimensional compressible flow of a gas with discontinuities are presented. The numerical analogue to experimental techniques such as schlieren imaging, shadowgraphs, and interferograms are discussed. Edge detection techniques are utilized to identify the discontinuities. In particular, the zero crossing of the Laplacian of a field (usually density) is recommended for extracting the discontinuities. An algorithm to extract and quantify the discontinuities is presented. To illustrate the methods developed in the report, the example chosen is that of an unsteady interaction of a shock wave with a contact discontinuity.
Author

Extraction; Quantitative Analysis; Compressible Flow; Gas Flow; Shadowgraph Photography; Optical Tracking

20000069007 NASA Ames Research Center, Moffett Field, CA USA

Large-Scale Distributed Computational Fluid Dynamics on the Information Power Grid Using Globus

Barnard, Stephen, MRJ Technology Solutions, USA; Biswas, Rupak, Sterling Software, Inc., USA; Saini, Subhash, NASA Ames Research Center, USA; VanderWijngaart, Robertus, MRJ Technology Solutions, USA; Yarrow, Maurice, Sterling Software, Inc., USA; Zechtzer, Lou, MRJ Technology Solutions, USA; Foster, Ian, Argonne National Lab., USA; Larsson, Olle, Argonne National Lab., USA; [1999]; 8p; In English; Frontiers, 21-25 Feb. 1999, Annapolis, MD, USA
Contract(s)/Grant(s): NAS2-14303; NAS2-13619; RTOP 519-40-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes an experiment in which a large-scale scientific application development for tightly-coupled parallel machines is adapted to the distributed execution environment of the Information Power Grid (IPG). A brief overview of the IPG and a description of the computational fluid dynamics (CFD) algorithm are given. The Globus metacomputing toolkit is used as the enabling device for the geographically-distributed computation. Modifications related to latency hiding and Load balancing were required for an efficient implementation of the CFD application in the IPG environment. Performance results on a pair of SGI Origin 2000 machines indicate that real scientific applications can be effectively implemented on the IPG; however, a significant amount of continued effort is required to make such an environment useful and accessible to scientists and engineers.
Author

Large Scale Integration; Computational Fluid Dynamics; Experimentation; Information Flow

20000069642 Norwegian Defence Research Establishment, Kjeller, Norway

Evaluation of CLAWPACK with Gravity and Multiple Phases for Use in Marine Technology

Glattetre, Geir Thomas, Norwegian Defence Research Establishment, Norway; Feb. 24, 2000; 56p; In English
Contract(s)/Grant(s): FFIBM Proj. 410501/170
Report No.(s): FFI/RAPPORT-2000/01060; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This thesis concerns the use of the program package CLAWPACK (Conservation LAWs PACKage) in problems related to marine technology. Problems investigated are vortex shedding, multiple phases and gravity. This thesis includes mathematical

theory of the governing equations and principles of CLAWPACK. Further, it contains a discussion on boundary conditions, several ways of handling gravity and validation tests with results and discussions.
Author
Vortex Shedding; Gravitation; Computational Fluid Dynamics

20000070322 Michigan Univ., Dept. of Mechanical Engineering and Applied Mechanics, Ann Arbor, MI USA
Computational Investigation of Atomization *Final Report, 1 Jul.-31 Dec. 1999*
Tryggvason, Gretar, Michigan Univ., USA; Mar. 31, 2000; 45p; In English
Contract(s)/Grant(s): F49620-99-1-0314; AF Proj. 2308
Report No.(s): AD-A377695; AFRL-SR-BL-TR-00-0782; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The secondary breakup of liquid fuel drops was studied by numerical simulations. The Navier-Stokes equations were solved by a finite difference/front tracking technique that included inertia, viscous forces, and surface tension at the deformable boundary between the fuel and the air. The breakup of drops accelerated impulsively was studied by axisymmetric simulations for two different density ratios (1.15 and 10). The low density ratio results can be used for other density ratios by simple rescaling of time. It was shown that the drops break up in different modes, depending on the relative strength of surface tension versus inertia. The modes are similar to those found experimentally for drops in air at atmospheric pressure and breakup maps constructed from the computational results show similar transitions. There are, however, some differences. Bag breakup is, for example, not found for impulsively accelerated drops in the low density ratio limit. Computations of the breakup of cold drops in hot ambient show a rapid increase in heat transfer, and the drops often reach the ambient temperature before breakup is completed.
DTIC
Liquid Fuels; Atomizing; Mathematical Models; Computerized Simulation

20000070330 Army Engineer Waterways Experiment Station, Coastal Hydraulics Lab., Vicksburg, MS USA
Unrestrained Cylinders Rolling in Steady Uniform Flows *Final Report*
Davis, Jack E.; Apr. 2000; 136p; In English
Report No.(s): AD-A377851; ERDC/CHL-TR-00-7; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Ordnance remediation projects for underwater sites have suggested that understanding the motion of cylinders (the approximate shape of ordnance) in flows would help to predict regions of ordnance mobility, prioritize remediation efforts, and improve the design of engineering works trap ordnance. Therefore, to develop a better understanding of the motion of cylinders, the characteristics of motion of smooth, unrestrained cylinders in contact with a smooth horizontal bed were investigated in a flume with steady, uniform flows. Inviscid flow theory was used to estimate maximum cylinder velocities and numerical simulations were used to understand the hydrodynamic forces on the cylinders. Eight cylinders were used in the laboratory experiments having varying specific gravities and diameters. At low velocities, experiments showed that the cylinders follow trends similar to those noted in sediment particle studies. Incipient motion velocities were highest for the heavier cylinders. At high flows, the terminal velocity of the cylinders was limited to between 60-80 percent of the free stream flow. The cylinders accelerated to their maximum velocities within about one second. Inviscid-flow theory derivations implied that the maximum velocity of the cylinder would be 71 percent of the free stream flow which was consistent with the experiments. Use of potential flow theory was assumed valid (as an estimator) because experiments verified that flow over the rolling cylinder did not separate from the cylinder surface and that they were reasonably two-dimensional. The numerical results showed that separation from the cylinder would be eliminated by the moving surface of the cylinder. In fact, suppression of separation occurred even when the cylinder was rolling at only 60 percent of the free-stream flow velocity.
DTIC
Hydrodynamics; Inviscid Flow; Statistical Analysis; Potential Flow

20000070360 MRJ Technology Solutions, Moffett Field, CA USA
Geometric Representations of Condition Queries on Three-Dimensional Vector Fields
Henze, Chris, MRJ Technology Solutions, USA; [1999]; 10p; In English; Visualization, 24-29 Oct. 1999, San Francisco, CA, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-72; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Condition queries on distributed data ask where particular conditions are satisfied. It is possible to represent condition queries as geometric objects by plotting field data in various spaces derived from the data, and by selecting loci within these derived spaces which signify the desired conditions. Rather simple geometric partitions of derived spaces can represent complex condition queries because much complexity can be encapsulated in the derived space mapping itself A geometric view of condition queries provides a useful conceptual unification, allowing one to intuitively understand many existing vector field feature detection algorithms -- and to design new ones -- as variations on a common theme. A geometric representation of condition queries also provides

a simple and coherent basis for computer implementation, reducing a wide variety of existing and potential vector field feature detection techniques to a few simple geometric operations.

Author

Computational Fluid Dynamics; Detection; Flow Visualization

20000070447 Mississippi State Univ., Computational Fluid Dynamics Lab., Mississippi State, MS USA

Mixed Element Type Unstructured Grid Generation for Viscous Flow Applications

Marcum, David L., Mississippi State Univ., USA; Gaither, J. Adam, Mississippi State Univ., USA; July 2000; 12p; In English

Contract(s)/Grant(s): NAG1-1990

Report No.(s): MSSU-COE-ERC-00-06; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A procedure is presented for efficient generation of high-quality unstructured grids suitable for CFD simulation of high Reynolds number viscous flow fields. Layers of anisotropic elements are generated by advancing along prescribed normals from solid boundaries. The points are generated such that either pentahedral or tetrahedral elements with an implied connectivity can be be directly recovered. As points are generated they are temporarily attached to a volume triangulation of the boundary points. This triangulation allows efficient local search algorithms to be used when checking merging layers, The existing advancing-front/local-reconnection procedure is used to generate isotropic elements outside of the anisotropic region. Results are presented for a variety of applications. The results demonstrate that high-quality anisotropic unstructured grids can be efficiently and consistently generated for complex configurations.

Author

Computational Fluid Dynamics; Grid Generation (Mathematics); Simulation; Unstructured Grids (Mathematics)

20000070476 Northwestern Univ., Dept. of Mechanical Engineering and Astronautical Sciences, Evanston, IL USA

Multiresolution Analysis of Compressible Viscous Flow-Structure Interaction *Final Report, 1 May 1996-30 Sep 1999*

Liu, Wing K., Northwestern Univ., USA; Mar. 2000; 17p; In English

Contract(s)/Grant(s): F49620-96-1-0171; AF Proj. 2302

Report No.(s): AD-A377739; AFRL-SR-BL-TR-00-0185; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Since fluid-structure interaction requires solid mathematical modeling of the various physical phenomena of solids/structure and fluids. The research efforts reported here have been focused on the development of multiple-scale Reproducing-Kernel Particle Methods (RKPM) which possess a few remarkable technical advantages from a computational mechanics point of view, such as mesh-free interpolation functions and superior accuracy and convergence rate with stabilization. Most importantly, with the inherent multi resolution analysis capability, RKPM issued to further investigate the physical nature of fluid-structure interaction problems in a way that the system response can be decomposed into multiple frequency wave number bands for a better repres-physics.

DTIC

Mathematical Models; Computational Fluid Dynamics; Viscous Flow; Compressible Flow; Image Resolution

20000070556 La Sapienza Univ., Rome, Italy

Vortical Structures in Rotating and Stratified Fluids. EUROMECH Colloquium 396 with ERCOFTAC and TAO Workshops

Jun. 1999; 99p; In English, 22-25 Jun. 1999; Sponsored by La Sapienza Univ., Italy; Meeting sponsored in part by ERCOFTAC

Report No.(s): AD-A368734; No Copyright; Avail: CASI; A02, Microfiche; A05, Hardcopy

This conference paper presents a collection of abstracts on vortical structures in rotating and stratified fluids.

CASI

Conferences; Rotating Fluids; Stratified Flow; Vortices; Turbulent Flow

20000070667 Institut National Polytechnique, Grenoble, France

Two-phase flows during a discharge of liquefied gases, initially at saturation. Effect of the nature of the fluid

Alix, P.; Oct. 03, 1997; 220p; In French; In English

Report No.(s): DE99-713701; FRNC-TH-4085; No Copyright; Avail: Department of Energy Information Bridge

In the case of a confinement loss (breakage of a connection piece) on a pressurized liquefied gas tank, a critical two-phase (liquid-vapour) flow is generated. This thesis is aimed at the validation of models describing these flows with various fluids (water, R 11, methanol, ethyl acetate, pure butane, commercial butane), using a pilot experimental plant. Results show that reduced

upstream pressure is the main parameter, thus indicating that a model can be validated using minimal fluids. The homogenous models DEM and HRM appear to be more precise

NTIS

Liquefied Gases; Two Phase Flow; Critical Flow; Discharge; Mathematical Models

20000070760 National Inst. of Standards and Technology, Process Measurements Div., Gaithersburg, MD USA

Heat Transfer of Supercritical Carbon Dioxide Flowing in a Cooled Horizontal Tube

Olson, Douglas A., National Inst. of Standards and Technology, USA; May 2000; 208p; In English

Report No.(s): PB2000-104379; NISTIR-6496; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

The authors report measurements of heat transfer coefficients of flowing supercritical carbon dioxide in a cooled horizontal tube. The tube was 10.9 mm ID, was cooled over 274 cm, and had an adiabatic entrance section of 55.9 cm. Cooling was accomplished by flowing cold water countercurrent to the carbon dioxide in an annual gap between the inner tube (12.7 mm OD) and an outer tube (16.6 mm ID). This set a convective boundary condition similar to what would be encountered in a counterflow heat exchanger. The four experimental parameters found to affect the heat transfer coefficients, and their ranges tested, were: operating pressure (7.409 MPa to 13.0 MPa), CO2 mass flow rate, rate of heat removal by cooling (1780 W to 6220 W), and CO2 average temperature. The Reynolds number range at the CO2 average temperature was 63 250 to 291 700. Conditions which resulted in the highest heat transfer coefficients were pressure close to the critical, high mass flow rate, and temperature close to the pseudo-critical.

NTIS

Heat Transfer; Supercritical Flow; Turbulent Flow; Carbon Dioxide; Gas Flow; Cooling; Convection

20000070798 Alabama Univ., Huntsville, AL USA

A Dynamic Model for the Interaction Between an Insoluble Particle and an Advancing Solid/Liquid Interface

Catalina, A. V., Alabama Univ., USA; Mukherjee, S., Alabama Univ., USA; Stefanescu, D. M., Alabama Univ., USA; [2000]; 1p; In English

Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

Most models that describe the interaction of an insoluble particle with an advancing solid-liquid interface are based on the assumption of steady state. However, as demonstrated by experimental work, the process does not reach steady state until the particle is pushed for a while by the interface. In this work, a dynamic mathematical model was developed. The dynamic model demonstrates that this interaction is essentially non-steady state and that steady state eventually occurs only when solidification is conducted at sub-critical velocities. The model was tested for three systems: aluminum-zirconia particles, succinonitrilepolystyrene particles, and biphenyl-glass particles. The calculated values for critical velocity of the pushing/engulfment transition were in same range with the experimental ones.

Author

Dynamic Models; Liquid-Solid Interfaces; Solubility; Particle Interactions; Mathematical Models

20000073393 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Integrity Assessment of GOH Heater Tube

Lee, B. S.; Hong, J.; Oh, Y.; Yoon, J.; Oh, J.; Aug. 31, 1997; 74p; In Korean; In English

Report No.(s): DE99-727787; KAERI-CR-36/97; No Copyright; Avail: Department of Energy Information Bridge

An assessment of structural integrity of ASTM A312-TP347 GOH heater tube was performed. The surface notches which had been produced during tube manufacturing process were analyzed microscopically. Chemical analysis, hardness tests, tensile tests, and J-Integral fracture resistance tests were carried out to compare the mechanical properties with those of the material specification and also with the other material of the same type. The test results showed the mechanical properties of the GOH tube material are within the specification range. An elastic-plastic fracture mechanics analysis based on the DPFAD method reveals the tube an appropriate safety margin for the normal operation. 13 refs., 5 tabs., 24 figs. (author).

Author(NTIS)

Tubes; Chemical Analysis; Fracture Strength; Heating Equipment; Pipes (Tubes); Reactor Materials; Structural Failure; Elastic Properties; Hardness Tests

20000073738 Electricite de France, Direction des Etudes et Recherches, Clamart, France

Numerical study of the flow in a ball bearing cross-section

Combes, J. F.; Bidot, T.; Jan. 31, 1997; 14p; In French; In English

Report No.(s): DE99-723894; EDF-97-NB-00114; No Copyright; Avail: Department of Energy Information Bridge

In the Ariane rocket propulsion system, ball bearings operate under very severe conditions; in order to evaluate heat transfers enabling their cooling, the flow inside the bearings themselves has to be determined. A numerical study has been carried out by Simulog company using the Turbomachinery release of the N3S code developed by Electricite de France. After a brief presentation of the fluid dynamics N3S code and its turbomachinery version, its application to the calculation of the flow within a ball bearing is presented: as it was shown in a preliminary study, the 3D flow can be split into a succession of 2D flows on parallel slices; therefore examples of laminar and turbulent flow calculation on a cross section are given. Comparison of flow structure calculations with experimental and analytical results is discussed.

NTIS

Laminar Flow; Ball Bearings; Turbulent Flow; Fluid Mechanics

20000074111 NASA Marshall Space Flight Center, Huntsville, AL USA

Modeling of Ultrasonically Generated Liquid-Liquid Dispersions During Controlled Directional Solidification

Grugel, R. N., NASA Marshall Space Flight Center, USA; Fedoseyev, A. I., Alabama Univ., USA; [2000]; 1p; In English, 8 Oct. 2000, Stony Brook, NY, USA; No Copyright; Avail: Issuing Activity; Abstract Only

There are innumerable two-component systems in which two very different liquid phases co-exist in equilibrium over a range of temperature and composition, e.g., oil and water, salt fluxes and solders, aluminum and lead. Often it is of practical concern to fabricate a solid component consisting of a uniform dispersion of one phase in the other. Unfortunately, uniform microstructural development during solidification of two immiscible liquids is hampered by inherent, often large, density differences between the phases that lead to severe segregation. Uniformity is also compromised by preferential wetting and coalescence phenomena. It is, however, well known that ultrasonic energy can initiate and maintain a fine liquid-liquid dispersion. The work presented here extends that observation by application of ultrasonic energy to promote uniform phase incorporation during controlled directional solidification. to this end experiments with the transparent organic, immiscible, succinonitrile-glycerol system were conducted and the numerous processing parameters associated with this technique were evaluated in view of optimizing dispersion uniformity. In view of the initial experimental results a model that predicts the dispersed liquid droplet size as a function of material properties, sample geometry, and applied energy has been developed. In the mathematical model we consider the ultrasonic field in an experimental ampoule of length L and diameter D induced by a probe having a vibration frequency of f=2OKhz (circular frequency omega = 2 pi f). The amplitude is adjustable from A=65 to 13Omicrons. The probe tip diameter is d, the liquid has a density of p, in which the speed of sound and surface tension are, respectively, c and sigma. The mathematical model and numerical investigation for the experiments [1] is done using the following assumptions: (i) The droplet size is small in comparison to the sound wave length; (ii) The forces between droplets are neglected (relative concentration is small); (iii) The droplet is stable if the kinetic energy, E(sub K), of the liquid motion due to ultrasonic field influence is less then the binding energy, E(sub S), due to the surface tension (it is easy to show that the surface energy of two droplets resulting from one is larger by about a factor of two.); (iv) The stability limit is characterized by E(sub S) to approx. E(sub K).

Author

Liquid Phases; Directional Solidification (Crystals); Ultrasonics; Interfacial Tension; Drops (Liquids); Mathematical Models

35
INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Avionics and Aircraft Instrumentation; and 19 Spacecraft Instrumentation.

20000068536 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Laser Cooled Atomic Clocks in Space

Thompson, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Kohel, J., Jet Propulsion Lab., California Inst. of Tech., USA; Klipstein, W. M., Jet Propulsion Lab., California Inst. of Tech., USA; Seidel, D. J., Jet Propulsion Lab., California Inst. of Tech., USA; Maleki, L., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 7p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goals of the Glovebox Laser-cooled Atomic Clock Experiment (GLACE) are: (1) first utilization of tunable, frequency-stabilized lasers in space, (2) demonstrate laser cooling and trapping in microgravity, (3) demonstrate longest 'perturbation-free' interaction time for a precision measurement on neutral atoms, (4) Resolve Ramsey fringes 2-10 times narrower than achievable on Earth. The approach taken is: the use of COTS components, and the utilization of prototype hardware from LCAP flight defini-

tion experiments. The launch date is scheduled for Oct. 2002. The Microgravity Science Glovebox (MSG) specifications are reviewed, and a picture of the MSG is shown.
CASI
Atomic Clocks; Laser Cooling; Tunable Lasers; Autonomous Spacecraft Clocks

20000069850 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
RD-674B/UNH and RD-68lA/UNH Recorder-Reproducer Information Sheets
Durkin, Matthew; Jan. 2000; 5p; In English
Report No.(s): AD-A377923; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
     The RD-681A/UNH is a commercial off the shelf (COTS), PC-based, state of the art, voice recording system that automatically records when voice signals are present at any one of 32 input channels. It operates in the Windows NT TM environment & can record 32 audio channels (expandable to 80). Digital interface options are available. The system can be housed in a standard ElA cabinet with a 19-inch rack configuration. A major advantage of the RD-68IA/UNH is that audio recording need not be interrupted to provide simultaneous & synchronized playback of four channels of audio. The RD-674B/UNH was developed to replace the RD-379/390 recorder & RP-214 reproducer, which are no longer manufactured or supported by industry sources & are obsolete, unreliable, & costly to maintain. The RD-674B/UNH is a commercial-off- the-shelf (COTS), PC-based, state-of-the-art, voice recording system that automatically records when voice signals are present at any one of 32 input channels. It operates in the Windows NT TM environment & can record 32 audio channels (expandable to 80). Digital interface options are available. The system can be housed in a standard ElA cabinet with a 19-inch rack configuration.
DTIC
Voice Communication; Playbacks; Sound Transmission

20000069858 Illinois Univ. at Urbana-Champaign, Dept. of Electrical and Computer Engineering, Urbana, IL USA
Ultra-Fast Optical Signal Encoding and Analysis for Communications and Data Fusion Networks *Final Report, 1 Apr. 1996-31 Mar. 1999*
Brady, David J.; Coleman, James J.; Purchase, Kenneth G.; May 01, 2000; 59p; In English
Contract(s)/Grant(s): F49620-96-1-0163
Report No.(s): AD-A377846; AFRL-SR-BL-TR-00-0793; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
     We describe the distributed Bragg pulse shaper, the quantum dot spectrometer and interferometric imaging systems developed under this program. The distributed Bragg pulse shaper is a series of partially reflecting Bragg mirrors constructed over an integrated optical waveguide. Through parallel electrical modulation of the Bragg mirror resonances one can encode terahertz bandwidth optical signals with this device. Quantum dot detectors and interferometric sensors provide complementary technologies for detecting such signals. Quantum dot spectrometers combine the spectral discrimination of quantum confined absorption with resonant tunneling for channel isolation. Interferometric systems map spectral or temporal signal features onto spatially separate channels. In this sense, interferometry acts as a serial-to-parallel complement to the parallel-to-serial action of the pulse shaper.
DTIC
Optical Communication; Signal Encoding; Imaging Techniques; Optical Waveguides; Shapers

20000070438 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
In Situ Instruments: Overview of In Situ Instruments for Deployment in Extreme Environments
Taylor, M., Jet Propulsion Lab., California Inst. of Tech., USA; Cardell, G., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 26p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
     This presentation reviews the design and specifications for several instruments for deployment in extreme environments. The instruments are: (1) In Situ Geochronology Instrument, (2) Laser Ablation Sampling Instrument, (3) Micro Hygrometer (4) Micro Lidar, (5) Atmospheric Electron X-Ray Spectrometer and (6) Nuclear Magnetic Resonance Spectrometer. Included in the descriptions are the contact people and the objective of each instrument.
Author
Hygrometers; Laser Ablation; Optical Radar; X Ray Spectrometers; Microminiaturization; Thermal Environments

20000070444 Arizona Univ., Optical Sciences Center, Tucson, AZ USA
Atomic Lithography: Forcing Epitaxial Growth Using X-Ray Standing Waves *Final Report, Jul. 1997-Sep. 1999*
Falco, Charles M., Arizona Univ., USA; Fischer, Gerd M., Arizona Univ., USA; Keavney, David J., Arizona Univ., USA; Sep. 1999; 8p; In English

In a remarkably short time we have made tremendous progress in both the design and construction of a unique "atomic lithography" deposition facility, and in observing effects of an intense x-ray beam on the growth morphology of a thin semiconductor film. Now, with follow-on funding, we believe we are in a position to achieve the ambitious goals of this project. That is, to use a standing x-ray wave to template the growth of crystalline materials on amorphous substrates.
DTIC

Atomic Layer Epitaxy; Lithography; SOI (Semiconductors)

20000070481 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Cancellation of Laser Noise in Space-Based Interferometer Detectors of Gravitational Radiation

Tinto, Massimo, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 6p; In English, 23-30 Jan. 1999, Les Arcs, France; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We presented a time-domain procedure for accurately cancelling laser noise fluctuations in an unequal-arm Michelson interferometer. The method involves separately measuring the phase of the returning light relative to the phase of the transmitted light in each arm. by suitable offsetting and differencing of these two time series, the common laser noise is cancelled exactly. The technique presented in this paper is general, in such that it can be implemented with any (Earth as well as space-based) unequal-arms Michelson interferometers,
Author

Michelson Interferometers; Laser Outputs; Gravitational Waves; Cancellation; Time Domain Analysis

20000070845 Southwest Research Inst., San Antonio, TX USA

Ultrasonic Meter Testing for Storage Applications *Final Report, Jan. 1997 - Mar. 1998*

Grimley, T. A.; Dec. 1998; 44p; In English; Original contains color illustrations

Laboratory tests of commercially available 8-inch diameter single- and multipath ultrasonic flow meters were conducted as part of this study to assess their performance in natural gas storage field applications. The lab evaluation tests determined the sensitivity of ultrasonic gas flow meters to gas pressure and temperature variations. The performance of the meters under bi-directional flow conditions was also assessed to establish the range over which an accurate flow rate measurement can be obtained. Lab tests were also performed to quantify the magnitude of the volumetric flow rate measurement error caused by the presence of a thermowell upstream of the meter, and to establish guidelines on placement of the thermowell so as to minimize or eliminate this error source. In addition to collecting ultrasonic flow meter test data at the Metering Research Facility, Southwest Research Institute staff also collected and analyzed field meter performance data from gas transmission pipeline operators in the United States. Several pipeline operators have performed field evaluations of ultrasonic flow meters ranging in size from 304.8 to 508 millimeters (12 to 20 inches) in diameter. Significant findings and observations from these field evaluations are included in this report.
NTIS

Flowmeters; Ultrasonic Tests; Gas Flow; Storage Tanks; Natural Gas

20000070856 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Noise and Bandwidth Measurements of Diffusion-Cooled Nb Hot-Electron Bolometer Mixers at Frequencies Above the Superconductive Energy Gap

Wyss, R. A., Jet Propulsion Lab., California Inst. of Tech., USA; Karasik, B. S., Jet Propulsion Lab., California Inst. of Tech., USA; McGrath, W. R., Jet Propulsion Lab., California Inst. of Tech., USA; Bumble, B., Jet Propulsion Lab., California Inst. of Tech., USA; LeDuc, H., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 12p; In English; 10th; Space THz Technology, 16-18 Mar. 1999, Charlottesville, VA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Diffusion-cooled Nb hot-electron bolometer (HEB) mixers have the potential to simultaneously achieve high intermediate frequency (IF) bandwidths and low mixer noise temperatures for operation at THz frequencies (above the superconductive gap energy). We have measured the IF signal bandwidth at 630 GHz of Nb devices with lengths L = 0.3, 0.2, and 0.1 micrometer in a quasioptical mixer configuration employing twin-slot antennas. The 3-dB EF bandwidth increased from 1.2 GHz for the 0.3 gm long device to 9.2 GHz for the 0.1 gm long device. These results demonstrate the expected 1/L squared dependence of the IF bandwidth at submillimeter wave frequencies for the first time, as well as the largest EF bandwidth obtained to date. For the 0.1 gm device, which had the largest bandwidth, the double sideband (DSB) noise temperature of the receiver was 320-470 K at 630 GHz with an absorbed LO power of 35 nW, estimated using the isothermal method. A version of this mixer with the antenna length scaled for operation at 2.5 THz has also been tested. A DSB receiver noise temperature of 1800 plus or minus 100 K was achieved,

which is about 1,000 K lower than our previously reported results. These results demonstrate that large EF bandwidth and low-noise operation of a diffusion-cooled HEB mixer is possible at THz frequencies with the same device geometry.
Author
Bandwidth; Bolometers; Diffusion; Hot Electrons; Niobium; Mixing Circuits; Noise Temperature; High Frequencies; Energy Gaps (Solid State)

20000072441 NASA Goddard Space Flight Center, Greenbelt, MD USA
Mars surface gas chromatograph mass spectrometer
Mahaffy, P., NASA Goddard Space Flight Center, USA; [2000]; 6p; In English; Concepts and Approaches for Mars Explore, 17-21 Jul. 2000, TX, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A Mars surface lander Gas Chromatograph Mass Spectrometer (GCMS) is described to measure the chemical composition of abundant and trace volatile species and isotope ratios for noble gases and other elements. These measurements are relevant to the study of atmospheric evolution and past climatic conditions. A Micromission plan is under study where a surface package including a miniaturized GCMS would be delivered to the surface by a solar heated hot air balloon based system. The balloon system would be deployed about 8 km above the surface of Mars, wherein it would rapidly fill with Martian atmosphere and be heated quickly by the sun. The combined buoyancy and parachuting effects of the solar balloon result in a surface package impact of about 5 m/sec. After delivery of the package to the surface, the balloon would ascend to about 4 km altitude, with imaging and magnetometry data being taken for the remainder of the daylight hours as the balloon is blown with the Martian winds. Total atmospheric entry mass of this mission is estimated to be approximately 50 kg, and it can fit as an Ariane 5 piggyback payload.
Derived from text
Gas Chromatography; Mars Atmosphere; Mars Surface; Mass Spectrometers; Wind (Meteorology)

20000072471 Carnegie-Mellon Univ., Robotics Inst., Pittsburgh, PA USA
A System for Video Surveillance and Monitoring CMU VSAM Final Report *Final Report*
Kanade, Takeo; Collins, Robert T.; Lipton, Alan J.; Fujiyoshi, Hironobu; Duggins, David; Nov. 30, 1999; 135p; In English; Prepared in cooperation with The Sarnoff Corp., Princeton, NJ.
Contract(s)/Grant(s): DAAB07-97-C-J031; N00014-99-1-0646
Report No.(s): AD-A376952; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Under the three-year Video Surveillance and Monitoring (VSAM) project, the Robotics Institute at Carnegie Mellon University (CMU) and the Sarnoff Corporation have developed a system for autonomous Video Surveillance and Monitoring. The technical approach uses multiple, cooperative video sensors to provide continuous coverage of people and vehicles in a cluttered environment. This final report presents an overview of the system, and of the technical accomplishments that have been achieved. Details can be found in a set of previously published papers that together comprise Appendix A.
DTIC
Surveillance; Monitors; Video Equipment

20000072493 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Overview of the Keck Interferometer
vanBelle, Gerard, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 42p; In English; VLT Opening Symposium, 2 Mar. 1999, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is a presentation about the Keck Interferometer which is being constructed on top of Mauna Kea, Hawaii. This includes using the world's largest telescopes for optical and near-infrared astronomy, the twin 10 meter Keck telescopes. The two Keck telescopes, in conjunction with four proposed outrigger telescopes, will be used as an interferometer to conduct observations as part of NASA's Origins Program. These observations will address a variety of topics, including the origin and evolution of planetary systems. This presentation reviews the key features of the interferometer, and the specifications of the telescopes that will be used. It shows diagrams of the site, and the basement layout. It also reviews the science for which the interferometer will be used.
CASI
Interferometers; Telescopes; Astronomical Interferometry; Extrasolar Planets; Cosmic Dust; Astrometry

20000073229 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
8-9 and 14-15 Micron Two-Color 640x486 GaAs/AlGaAs Quantum Well Infrared Photodetector (QWIP) Focal Plane Array Camera
Gunapala, S. D., Jet Propulsion Lab., California Inst. of Tech., USA; Bandara, S. V., Jet Propulsion Lab., California Inst. of Tech., USA; Singh, A., Air Force Research Lab., USA; Liu, J. K., Jet Propulsion Lab., California Inst. of Tech., USA; Rafol, S. B., Jet

Propulsion Lab., California Inst. of Tech., USA; Luong, E. M., Jet Propulsion Lab., California Inst. of Tech., USA; Mumolo, J. M., Jet Propulsion Lab., California Inst. of Tech., USA; Tran, N. Q., Jet Propulsion Lab., California Inst. of Tech., USA; Vincent, J. D., Raytheon Co., USA; Shott, C. A., Raytheon Co., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

An optimized long-wavelength two-color Quantum Well Infrared Photodetector (QWIP) device structure has been designed. This device structure was grown on a three inch semi-insulating GaAs substrate by molecular beam epitaxy (MBE). This wafer was processed into several 640x486 format monolithically integrated 8-9 and 14-15 micron two color (or dual wavelength) QWIP focal plane arrays (FPAs). These FPAs were then hybridized to 640x486 silicon CMOS readout multiplexers. A thinned (i.e., substrate removed) FPA hybrid was integrated into a liquid helium cooled dewar to perform electrical and optical characterization and to demonstrate simultaneous two-color imagery. The 8-9 micron detectors in the FPA have shown background limited performance (BLIP) at 70 K operating temperature, at 300 K background with f/2 cold stop. The 14-15 micron detectors of the FPA have reached BLIP at 40 K operating temperature at the same background conditions. In this presentation we discuss the performance of this long-wavelength dualband QWIP FPA in quantum efficiency, detectivity, noise equivalent temperature difference (NEAT), uniformity, and operability.
Author
Gallium Arsenides; Aluminum Gallium Arsenides; Infrared Radiation; Semiconductors (Materials); Cameras

20000073710 Naval Postgraduate School, Monterey, CA USA
Exploratory Model Analysis of the Space Based Infrared System (SBIRS) Low Global Scheduler Problem
Morgan, Brian L.; Dec. 1999; 176p; In English
Report No.(s): AD-A374372; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Proliferation of theater ballistic missile technologies to potential U.S. adversaries necessitates that the U.S. employ a defensive system to counter this threat. The system that is being developed is called the Space-Based Infrared System (SBIRS) "System of Systems". The SBIRS Low component of the SBIRS "System of Systems" will track strategic and theater ballistic missiles from launch to reentry and relay necessary cueing data to missile interceptors before the missiles reach friendly forces or countries whose safety is a vital interest to the U.S. SBIRS Low has a number of critical system requirements that for any given satellite are mutually exclusive for the length of time needed to complete the specified tasking. This limitation implies a system capacity on the total number of ballistic objects the SBIRS Low system can track at any given time. Applying exploratory model analysis, the SBIRS Low model uses the Monte Carlo method to explore large regions of the model space to identify key factors in the system and to provide insight into different tasking schemes for individual satellites. The exploratory model analysis, which consisted of 13,760,000 missiles being tracked in the analysis of the CSS-2 and M-9 missiles, yielded the following significant results: (a) defining the "best" satellite is nontrivial, (b) the SBIRS Low system was unable to initiate a booster track for an unacceptably large percentage of M-9 missiles launched near the equator, (c) if the system anticipates a long delay in revisiting a track, a stereo view should be scheduled immediately prior to the start of the delay, (d) mono viewing alone does not provide the required track accuracy, (e) track accuracy is a function of missile classification, and (f) the instantaneous track accuracy versus sensor revisit rate does not fit an well-known probability distribution.
DTIC
Infrared Instruments; Missile Defense; Ballistic Missiles; Mathematical Models; Monte Carlo Method

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also 76 Solid-State Physics.

20000068917 NASA Ames Research Center, Moffett Field, CA USA
Coherent Pump-Probe Interactions and Terahertz Intersubband Gain in Semiconductor Quantum Wells
Liu, Ansheng, Arizona State Univ., USA; Ning, Cun–Zheng, NASA Ames Research Center, USA; [1999]; 2p; In English, 1999, Unknown; Sponsored by Lasers and Electro-Optics Society, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In recent years there has been considerable interest in intersubband-transition-based infrared semiconductor quantum well (QW) lasers because of their potential applications. In the mid-infrared range, both electrically-injected quantum cascade lasers [1] and optically-pumped multiple QW lasers [2] have been experimentally realized. In these studies, optical gain is due to popula-

tion inversion between the lasing subbands. It was also proposed that stimulated Raman scattering in QW systems can produce net infrared optical gain [3j. In such a nonlinear optical scheme, the appearance of optical gain that may lead to intersubband Raman lasers does not rely on the population inversion. Since, in tile resonant Raman process (Raman gain is the largest in this case), the pump field induces population redistribution among subbands in the QW s ystem, it seems that a realistic estimate of the optical gain has to include this effect. Perturbative calculations used in the previous work [3] may overestimate the Raman gain. In this paper we present a nonperturbative calculation of terahertz gain of optically-pumped semiconductor step quantum wells. Limiting optical transitions within the conduction band of QW, we solve the pump-field-induced nonequilibrium distribution function for each subband of the QW system from a set of coupled rate equations. Both intrasubband and intersubband relaxation processes in the quantum well system are included. Taking into account the coherent interactions between pump and THz (signal) waves, we we derive the susceptibility of the QW system for the THz field. For a GaAs/AlGaAs step QW, we calculate the Thz gain spectrum for different pump frequencies and intensities. Under moderately strong pumping (approximately 0.3 MW/sq cm), a significant THz gain (approximately 300/m) is predicted. It is also shown that the coherent wave interactions (resonant stimulated Raman processes) contribute significantly to the THz gain.

Derived from text

Raman Lasers; Semiconductor Lasers; Quantum Wells; Quantum Wires; Pumps

20000069031 Arizona Univ., Dept. of Mathematics, Tucson, AZ USA

Large Scale Electromagnetic Computation on Nonlinear Optical Systems: Hardware and Software Augmentation *Final Report, 1 Mar. 1998-28 Feb. 1999*

Moloney, J. V.; Mar. 03, 2000; 5p; In English

Contract(s)/Grant(s): F49620-97-1-0227

Report No.(s): AD-A376849; FRS-305610; AFRL-SR-BL-TR-00-0160; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The award went towards the purchase of an ONYX2 Silicon Graphics rack system with an Internal graphics engine and 8 256MHz CPUs. This system was chosen as it provided state-of-the-art graphical visualization and computing capabilities and offered a cost-effective upgrade route. The rack system Is directly linked to an earlier ONYX2 system obtained under a previous DURIP award. The in-house supercomputing engine has provided a significant boost to our AFOSR-funded research projects including the following: (1) Structural Dependence of the Linewidth Enhancement Factor: A Full Microscopic Many-Body Calculation; (2) An Interactive Supercomputing-based Simulator for High Brightness Laser Design; (3) High Power Femtosecond Atmospheric Light Strings; (4) Novel SHG for Femtosecond Pulses; and (5) Double Clad Fiber Amplifiers and Lasers for High Brightness Applications.

DTIC

Nonlinear Optics; Semiconductor Lasers; Computer Aided Design; Architecture (Computers); Computer Programs; Many Body Problem

20000069778 Research Inst. of National Defence, Div. of Sensor Technology, Linkoeping, Sweden

Lasmod: A Component Based Simulation Program for Laser Systems *Lasmod: Ett Komponentbaserat Simuleringsprogram foer Lasersystem*

Ekdahl, A.; Soederman, U.; Jun. 1999; 46p; In Swedish; Portions of this document are not fully legible

Report No.(s): PB2000-103063; FOA-R-99-01198-612-SE; No Copyright; Avail: National Technical Information Service (NTIS)

The report describes the laser simulation program (Lasmod) currently under development in FOA. The report describes the internal program design and shows the positive effects available by using modern concepts such as COM. Key concepts treated are: (1) Using existing components developed by third parties; (2) Modular design; (3) Reuse of developed components inside and outside of Lasmod. The program is developed for Windows 95/98/NT.

NTIS

Lasers; Software Engineering

20000069836 Washington Univ., Dept. of Electrical Engineering, Seattle, WA USA

Optical Coherent Transient Processors and True-Time-Delays *Final Report, 1 Mar. 1998 - 28 Feb. 1999*

Babbitt, Randall; Feb. 28, 1999; 7p; In English

Contract(s)/Grant(s): F49620-98-1-0277; AF Proj. 3484

Report No.(s): AD-A368297; AFRL-SR-BL-TR-99-0235; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The objectives of the research efforts supported by this DURIP award are to demonstrate and characterize the operation of optical coherent transient processing and true-time-delay devices at bandwidth well in excess of a gigahertz. The mode-locked Ti:Sapphire regenerative laser amplifier, associated pump laser combined with our existing, chirped laser system, and support equipment purchased with the DURIP funds has given us the capability to demonstrate and evaluate of coherent transient processing and true-time-delay devices in the 1-100 GHz bandwidth regime. Research in this operating regime is crucial to the development of high performance rf photonic systems critical to our national defense.

DTIC

Time Lag; Optical Computers

20000069853 University of Central Florida, Orlando, FL USA

Final Construction and Operation of a Continuous Far-Infrared Free-Electron Laser for Scientific Applications *Final Report, 1 Nov. 1998-31 Dec. 1999*

Dec. 31, 1999; 7p; In English

Contract(s)/Grant(s): N00014-92-J-4088

Report No.(s): AD-A377790; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

(1) to finalize the construction of a compact, high-power, CW FEL for the far-infrared (FIR) region. (2) Utilize the FEL for scientific applications. The expected average laser output power is 600 watts with 10-8 fractional spectral homogeneity and better than 20% overall wall power efficiency.

DTIC

Continuous Radiation; Continuous Wave Lasers; Free Electron Lasers; Far Infrared Radiation

20000069855 Lightwave Electronics Corp., Mountain View, CA USA

High-Power Mid-Infrared Laser Source *Final Report, 1 May 1999-31 Oct 1999*

Myers, Lawrence E.; Jan. 2000; 22p; In English

Contract(s)/Grant(s): F49620-99-C-0024

Report No.(s): AD-A377806; AFRL-SR-BL-TR-00-0176; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Characterization of a practical cw mode-locked pump laser based on passive mode-locking technology. Demonstration of a synchronously pumped optical parametric oscillator by a cw mode-locked laser with both linear and ring cavities. Demonstration of 0.36 W threshold, pump depletion of 83%, and maximum idler power of 0.85 W at 3.6 micrometers (with 6.9 of pump input). Demonstration of efficient OPO operation with PPLN crystals as short a 1 cm which is one absorption length at 5 micrometers.

DTIC

Laser Pumping; Laser Mode Locking; Continuous Radiation

20000070437 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Free Space Laser Communications

Lesh, James, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 23p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation concerns the use of Laser communication for deep space applications. The presentation reviews the problems with electromagnetic beams and then the advantages and disadvantages of the use of optical communication. The presentation then reviews some of the spacecraft technology with pictures of some of the devices. The ground reception systems and the simplified link calculation are also reviewed. Recent and planned demonstration projects are also reviewed.

CASI

Free-Space Optical Communication; Laser Beams; Satellite Communication; Space Communication

20000070451 NASA Ames Research Center, Moffett Field, CA USA

Ultrafast Modulation of Semiconductor Lasers Through a Terahertz Field

Ning, Cun–Zheng, NASA Ames Research Center, USA; Hughes, Steven, Washington State Univ., USA; Citrin, David, Washington State Univ., USA; [1998]; 6p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; NSF DMR-97-05403; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We demonstrate, by means of numerical simulation, a new mechanism to modulate and switch semiconductor lasers at THz and sub-THz frequency rates. A sinusoidal terahertz field applied to a semiconductor laser heats the electron-hole plasma and

consequently modifies the optical susceptibility. This allows an almost linear modulation of the output power of tile semiconductor laser and leads to a faithful reproduction of the terahertz-field waveform in the emitted laser intensity.
Author

Semiconductor Lasers; Modulation; Switches; Frequencies; Waveforms

20000070482 Brown Univ., Providence, RI USA

Laser Microfabrication in Glasses: Mechanisms and Applications *Final Report*

Lawandy, N. M.; Mar. 01, 1997; 6p; In English

Contract(s)/Grant(s): F49620-97-1-0179; AF Proj. 3484

Report No.(s): AD-A376443; AFRL-SR-BL-TR-00-0148; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Using DURIP funding the laser fabrication system was developed and constructed. A similar more compact system was also constructed using a diode-pumped frequency doubled Nd:YAG laser as the source.
DTIC

Fabrication; Laser Applications

20000070742 Air Force Research Lab., Sensors Directorate, Wright-Patterson AFB, OH USA

All-Solid-State Tunable (Cr2+) Laser *Final Report, 20 Feb 1997-31 May 1999*

Schepler, Kenneth L.; McKay, Jason; Jul. 1999; 29p; In English

Contract(s)/Grant(s): Proj-2301

Report No.(s): AD-A377645; AFRL-SN-WP-TR-1999-1104; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We investigated the spectroscopy and laser performance of Cr(2+) ions doped into II-VI semiconductors. Cr(2+) ions in CdSe exhibited strong broadband absorption in the 1.5-2.4 micron band peaked at 1.9 microns. Broadband fluorescence was present in the 1.8-2.8 micron region with a 6 microsecond lifetime in the 60-300 K temperature range. We demonstrated pulsed lasing of Cr(2+):CdSe using a 1 kHz, Q-switched, 2.05-micron, Tm, Ho:YLF pump laser. The Cr(2+):CdSe laser produced 500 mW of broadband output centered at 2.6 microns with 48% absorbed power conversion efficiency. With a larger pump beam to prevent coating damage, 815 mW was demonstrated. Tuning over the 2.3-2.9 micron range was demonstrated using a grating as the tuning element with 350 mW average power at the peak of the tuning curve.
DTIC

Tunable Lasers; Spectroscopy; Chromium; Ions

20000073316 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Diode Laser Measurements of HF Concentrations Produced from Heptane/Air Pan Fires Extinguished by FE-36, FM-200, FE-36 Plus APP, and FM-200 Plus APP *Final Report, 1 Jun.-1 Dec. 1998*

Skaggs, R. R.; Daniel, Robert G.; Miziolek, Andrzej W.; McNesby, Kevin L.; Herud, Craig; May 2000; 32p; In English

Contract(s)/Grant(s): Proj-1L161102AH43

Report No.(s): AD-A377480; ARL-TR-2225; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Tunable diode laser absorption spectroscopy (TDLAS) is used to measure the time evolution of hydrogen fluoride (HF) concentrations produced from a series of enclosed heptane/air pan fires extinguished by FE-36, FM-200, FE-36 plus ammonium polyphosphate (APP), and FM-200 plus APP. For the fires studied, the change in HF gas concentration with time is dependent upon the fire-fighting chemical used to extinguish the fire. The presence of APP is observed to reduce HF concentrations in the fire enclosure. Visible attenuation spectroscopy is also used to measure the amount of light attenuation (obscuration) that occurs as a hand-held fire extinguisher containing powder fire-fighting agent is released in the crew space of an M1-Abrams land combat vehicle.
DTIC

Fire Extinguishers; Absorption Spectra; Absorption Spectroscopy; Fire Fighting; Extinguishing; Tunable Lasers

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see 63 Cybernetics, Artificial Intelligence, and Robotics; and 54 Man/System Technology and Life Support.

20000068532 NASA Goddard Space Flight Center, Greenbelt, MD USA
NASA Lessons Learned from Space Lubricated Mechanisms
Predmore, Roamer E., NASA Goddard Space Flight Center, USA; April 2000; 15p; In English; Manufacturing Problem Prevention Program Meeting, 24-25 Apr. 2000, El Segundo, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document reviews the lessons learned from short-life and long life lubricated space mechanisms. A short-life lubricated mechanisms complete their life test qualification requirements after a few cycles. The mechanisms include the hinges, motors and bearings for deployment, release mechanisms, latches, release springs and support shops. Performance testing can be difficult and expensive but must be accomplished. A long-life lubricated mechanisms requires up to 5 years of life testing, or 10 to 100 years of successful flight. The long-life mechanisms include reaction wheels, momentum wheels, antenna gimbals, solar array drives, gyros and despin mechanisms. Several instances of how a mechanisms failed either in test, or in space use, and the lessons learned from these failures are reviewed. The effect of the movement away from CFC-113 cleaning solvent to ODC (Ozone-Depleting Chemical) -free is reviewed, and some of the alternatives are discussed.
CASI
Aerospace Engineering; Performance Tests; Lubrication Systems; Spacecraft Lubrication; Accelerated Life Tests

20000068923 Lockheed Martin Michoud Space Systems, New Orleans, LA USA
Autogeneous Friction Stir Weld Lack-of-Penetration Defect Detection and Sizing Using Directional Conductivity Measurements with MWM Eddy Current Sensor
Goldfine, Neil, JENTEK Sensors, Inc., USA; Zilberstei, Vladimir, JENTEK Sensors, Inc., USA; Lawson, Ablode, JENTEK Sensors, Inc., USA; Kinchen, David, Lockheed Martin Michoud Space Systems, USA; Arbegast, William, Lockheed Martin Michoud Space Systems, USA; [2000]; 33p; In English; Advanced Aerospace Materials and Processes, 26 Jun. 2000, Seattle, WA, USA
Contract(s)/Grant(s): NAS8-36200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Al 2195-T8 plate specimens containing Friction Stir Welds (FSW), provided by Lockheed Martin, were inspected using directional conductivity measurements with the MWM sensor. Sensitivity to lack-of-penetration (LOP) defect size has been demonstrated. The feature used to determine defect size was the normalized longitudinal component of the MWM conductivity measurements. This directional conductivity component was insensitive to the presence of a discrete crack. This permitted correlation of MWM conductivity measurements with the LOP defect size as changes in conductivity were apparently associated with metallurgical features within the first 0.020 in. of the LOP defect zone. Transverse directional conductivity measurements also provided an indication of the presence of discrete cracks. Continued efforts are focussed on inspection of a larger set of welded panels and further refinement of LOP characterization tools.
Author
Welded Joints; Penetration; Inspection; Detection; Defects; Cracks

20000070415 Lockheed Martin Michoud Space Systems, Program and Technology Development, New Orleans, LA USA
Lack of Penetration in Friction Stir Welds: Effects on Mechanical Properties and NDE Feasibility
Kinchen, David G., Lockheed Martin Michoud Space Systems, USA; Adams, Glynn P., Lockheed Martin Michoud Space Systems, USA; [2000]; 18p; In English; AeroMat, 29 Jun. 2000, Seattle, WA, USA
Contract(s)/Grant(s): NAS8-36200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation reviews the issue of lack of penetration (LOP) in Friction Stir Welding and the feasibility of using non-destructive tests to detect . Friction Stir Welding takes place in the solid phase below the melting point of the materials to be joined. It thus gives the ability to join materials which are difficult to fusion weld, for example 2000 and 7000 aluminium alloys. This process though can result in a lack of penetration, due to an incomplete penetration of the DXZ. This is frequently referred to as a "kissing bond", which requires micro examination to detect. The presentation then discusses the surface crack tension tests. It then reviews the simulated service test and results. It then discusses the feasibility of using non-destructive examination to detect LOP, the forms of test which can be used, and the results the tests.
Author
Friction Welding; Mechanical Properties; Nondestructive Tests; Penetration

20000070662 Helsinki Univ. of Technology, Lab. of Machine Design, Espoo, Finland
Tribology of Internal Combustion Engines. A Literature Survey
Andersson, P., Helsinki Univ. of Technology, Finland; Kytoe, M., Helsinki Univ. of Technology, Finland; Mustonen, M., Helsinki Univ. of Technology, Finland; Tamminen, J., Helsinki Univ. of Technology, Finland; Valkonen, A., Helsinki Univ. of Technology, Finland; Jan. 2000; 140p; In English; Sponsored in part by the National Technology Agency Tekes, the Finnish companies Fortum Oil and Gas Oy, Wartsaila NSD Corp., and Sisu Diesel, Inc.
Report No.(s): PB2000-105628; MACHINE DESIGN PUB-1/2000; Copyright; Avail: National Technical Information Service (NTIS)
     Contents include the following: An Introduction to Engine Tribology; Tribology of Internal Combustion Engines; Piston/ Ring/Cylinder Liner Tribology; Camshaft and Follower Tribology; Crankshaft Bearing Calculation; Crankshaft Bearing Tribology; Test Rigs for Crankshaft Bearings; Engine Lubricants; Engine Bearing Materials; Analysis of Worn and Damaged Surfaces; Conclusions.
NTIS
Internal Combustion Engines; Lubricants; Tribology

20000070735 NASA Marshall Space Flight Center, Huntsville, AL USA
Friction Stir Weld Modeling at MSFC: Kinematics
Nunes, Arthur C., Jr., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 4th; Aerospace Materials, Processes and Environmental Technology, 18-20 Sep. 2000, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity; Abstract Only
     A "merry-go-round" computation model makes it easier to visualize how tracer experiments of varied sorts (chemical, shot, wire) are consistent with a "moving plug model" of flow around the friction stir welding pin-tool. The moving plug model comprises a twofold flow: 1. a primary rotation of a plug of metal with the tool, which moves metal around the tool by wiping it on and off the plug, and 2. a secondary, relatively slow circulation induced by the threads on the tool resembling a circular vortex ring around the tool.
Author
Friction Welding; Kinematics

20000070870 NASA Marshall Space Flight Center, Huntsville, AL USA
Demonstration of a Large-Scale Tank Assembly via Circumferential Friction Stir Welds
Jones, Clyde S., NASA Marshall Space Flight Center, USA; Adams, Glynn, Lockheed Martin Michoud Space Systems, USA; Colligan, Kevin, Lockheed Martin Michoud Space Systems, USA; [2000]; 1p; In English; 11th; Aeromat, 26-29 Jun. 2000, Seattle, WA, USA; No Copyright; Avail: Issuing Activity; Abstract Only
     A collaborative effort between NASA/Marshall Space Flight Center and the Michoud Unit of Lockheed Martin Space Systems Company was undertaken to demonstrate assembly of a large-scale aluminum tank using circumferential friction stir welds. The hardware used to complete this demonstration was fabricated as a study of near-net- shape technologies. The tooling used to complete this demonstration was originally designed for assembly of a tank using fusion weld processes. This presentation describes the modifications and additions that were made to the existing fusion welding tools required to accommodate circumferential friction stir welding, as well as the process used to assemble the tank. The tooling modifications include design, fabrication and installation of several components. The most significant components include a friction stir weld unit with adjustable pin length capabilities, a continuous internal anvil for 'open' circumferential welds, a continuous closeout anvil, clamping systems, an external reaction system and the control system required to conduct the friction stir welds and integrate the operation of the tool. The demonstration was intended as a development task. The experience gained during each circumferential weld was applied to improve subsequent welds. Both constant and tapered thickness 14-foot diameter circumferential welds were successfully demonstrated.
Author
Assembling; Clamps; Fabrication; Friction Welding; Fusion Welding

20000073701 Sandia National Labs., Albuquerque, NM USA
CO2 Laser Weld Shape-Predicting Neural Network
Fuerschbach, P. W.; Knorovsky, G. A.; Oct. 05, 1998; 12p; In English; 17th; 17th International Congress on Applications of Lasers and Electro Optics, 16-19 Nov. 1998, Orlando, FL, USA
Report No.(s): DE00-000748; SAND98-1378C; No Copyright; Avail: National Technical Information Service (NTIS)
     We describe two artificial neural networks (ANN) which predict CO2 partial penetration laser welds on grade 304 stainless steel. Given the laser irradiance and travel speed, one ANN (direct) predicts the resulting weld's depth, width, overall shape,

energy transfer efficiency, melting efficiency and porosity likelihood in the weld fusion zone. Given the weld size and shape, the second ANN (inverse) predicts the irradiance and travel speed necessary to provide such a weld. The ANNs used 3 nodal layers and perception-type neurons. For the first ANN, with 2 inputs and 17 outputs (12 for shape, and 5 for size, efficiencies and porosity predictions), 12 to 17 intermediate layer neurons were necessary, while for the second, with 14 inputs and 2 outputs, 25 were necessary. Besides their description, data interpretation and weld schedule development via the ANNs will be shown.
NTIS

Neural Nets; Laser Welding; Carbon Dioxide Lasers

20000073739 Electricite de France, Direction des Etudes et Recherches, Clamart, France
Simulation of the behaviour of the turbine generator unit tilting pad bearings under heavy dynamic loading
Chan Hew Wai, C.; Desbordes, M.; Jan. 31, 1997; 47p; In French; In English
Report No.(s): DE99-723893; EDF-97-NB-00124; No Copyright; Avail: Department of Energy Information Bridge

The phenomena liable to affect the behaviour of a four-tilting-pad journal bearing, i.e. elastic deformations of the pad due to hydrodynamic pressures generated in the film, load-induced crushing of the pad at the interface with the support, and thermal effects in the lubricating film, have been quantified for two unbalance eccentricities. These effects mainly modify the amplitude of the trajectory of the center of the shaft. The pads, free in rotation on their pivot, can adapt to the operating conditions, inducing small variations in the minimum film thicknesses or maximum pressures. Once the three phenomena have been isolated, a general calculation is carried out for an unbalance eccentricity of 40 micrometers, considering elastic deformations, crushing and thermal effects. Since temperature variations over time are low, thermal dilatation of the solid components are also considered through the use of machining and assembly clearance values that have been experimentally determined. Results are compared with those obtained by traditional calculation methods, namely isothermal theory and rigid pad.
NTIS

Turbines; Journal Bearings; Electric Generators

20000073740 Electricite de France, Direction des Etudes et Recherches, Clamart, France
Experience feedback on the hydraulic unit swiveling provisions
Vialettes, J. M.; Claveirolle, P.; Francois, E.; Jan. 31, 1997; 30p; In French; In English
Report No.(s): DE99-723892; EDF-97-NB-00126; No Copyright; Avail: Department of Energy Information Bridge

EDF's 1300 hydraulic machines are highly diverse, ranging from 100 kW to 300 MW, and have been built over a period of almost one century; this diversity can also be found in the swiveling technologies that have been used, and many ancient designs still exist. The most frequently found swivel and bearing types are described, emphasizing their respective weaknesses; their protection systems (level, temperature, vibration control) and start-up and shutdown adapted procedures, are also presented. A feedback experience and analysis of significant incidents are presented, and the main causes of seizure are discussed. The various control methods concerning hydraulic circuits, bearing surfaces, edge and babbitt adhesion, are reviewed and control criterions for pad lining processes are presented.
NTIS

Swivels; Technology Assessment; Hydraulics

20000073741 Electricite de France, Direction des Etudes et Recherches, Clamart, France
Inspection of a 1300 MW turbine generator journal bearing supporting pad
Vialettes, J. M.; Dupuy, J.; Jan. 31, 1997; 20p; In French; In English
Report No.(s): DE99-723891; EDF-97-NB-00127; No Copyright; Avail: Department of Energy Information Bridge

Several inspections carried out on the journal bearing pads of 1300 MW PWR plant turbine generator units have notably revealed cracks in and separation of the anti-friction coating. In almost all the cases, the defects were caused by cracking of a compact and fragile layer of Cu_6Sn_5 located at the interface between the base metal and the babbitt metal. However, the damage initiating phenomenon was not clearly identified, leading to the examination of another journal bearing which showed the first signs of damage on the surface and base ultrasonic echo losses in the areas usually affected: a new mode of deterioration is shown, characterized by cracks and scales propagating to a few tens of millimeters under the surface of the babbitt metal. Several hypotheses can be proposed to explain this phenomenon: tearing due to large loads in static or transient conditions, damage due to surface fatigue, creep, and a combination of the last two phenomena. However, it does not seem that these defects represent an initiating phenomenon for the separations and cracking at the base/babbitt metal interface since no anomalies have been found heading for this area.
NTIS

Inspection; Turbines; Journal Bearings; Electric Generators

20000073742 Centre National de la Recherche Scientifique, Toulouse, France

Electrical assistance for S.I. engine idle speed control

Bidan, P.; Kouadio, I. K.; Valentin, M.; Montseny, G.; Jul. 31, 1997; 17p; In English

Report No.(s): DE99-723888; CNRS-LAAS-97303; No Copyright; Avail: Department of Energy Information Bridge

An original method for improving spark-ignition engine idling conditions, is presented. The proposed solution has the distinctive feature of simultaneously combining the traditional airflow rate control and the usual automobile alternator operating as a synchronous motor in order to provide a fast supplementary torque. Experimental validation of the electric assistance system is carried out on a production engine, and the new method is compared with the standard one in terms of idle stability, fuel consumption and pollution emissions.

NTIS

Engine Control; Spark Ignition; Internal Combustion Engines; Speed Control; Controllers

20000073747 Centre National de la Recherche Scientifique, Toulouse, France

Engine control-oriented fuzzy modeling

Bortolet, P.; Titli, A.; Boverie, S.; May 31, 1997; 8p; In English

Report No.(s): DE99-723883; CNRS-LAAS-97142; No Copyright; Avail: Department of Energy Information Bridge

A fuzzy model identification method, applied to the modeling of a spark ignition engine process aiming at optimization of combined fuel needs and power requirements, is presented. A model structure is defined and an original method is used to specify its different components. The method is tested on a simulated engine process in order to demonstrate the algorithm efficiency. Using a combination of elementary rules, Sugeno's models are defined where the conclusions of each rules are a linear combination of the air and torque model inputs, leading to the definition of piecewise controllers based on algorithmic linear control techniques or fuzzy control, or combinations of different techniques.

NTIS

Control Systems Design; Controllers; Spark Ignition; Internal Combustion Engines; Computer Aided Design

20000073799 Energia Nucleare e Delle Energie Alternative, Centro Ricerche Casaccia, Rome, Italy

Test facilities for hybrid and electric drive trains

Bernardini, G.; Ciancia, A.; De Andreis, L.; Pagni, G.; Pede, G.; Dec. 31, 1998; 22p; In Italian; In English

Report No.(s): DE99-722877; ENEA-RT-ERG-98-04; No Copyright; Avail: Department of Energy Information Bridge

ENEA (Italian National Agency for New Technologies, Energy and the Environment) is conducting a large research and development programme on innovative vehicles with high energy efficiency and low environmental impact. In particular conducts activities on electric and hybrid vehicles. Testing and evaluation activities play a strong role in this programme. A complete characterization chain has been then defined and set up with a network of facilities which covers main testing needs for single components, subsystems and complete vehicles, in simulated and real operating conditions. The test facility which has been realised is able to experiment and fully characterise complete drive-trains (and subsystems) for pure electric and hybrid vehicles. It is composed by a different section for each subsystem: (1) power generation; (2) energy storage and management; (3) driving motors. Each section acts as an experimental island, able to operate alone or jointly with the other sections. In fact, all the sections are remotely controlled and managed in order to create different assembly of the drive-train. The facility has been sized to allow the testing of drive-trains and subsystems of small and medium-sized vehicles (up to minibuses), but an extension to larger vehicles is possible. During 1996 and part of 1997 the Drive train Test Facility has been completed and made operative. This paper mainly presents the final configurations of these novel testing systems with peculiar features and characteristics.

NTIS

Test Facilities; Electric Hybrid Vehicles

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QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, inspection, maintainability, and standardization.

20000068445 National Inst. of Standards and Technology, Accreditation Program, Gaithersburg, MD USA

National Voluntary Laboratory Accreditation Program, 2000 Directory

White, Vanda R., Editor, National Inst. of Standards and Technology, USA; Mar. 2000; 398p; In English

Report No.(s): PB2000-105966; NIST/SP-810-ED-2000; No Copyright; Avail: CASI; A04, Microfiche; A17, Hardcopy

The National Institute of Standards and Technology (NIST) administers the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP is comprised of a series of laboratory accreditation programs (LAPs) which are established on the basis of requests and demonstrated need. Each LAP includes specific calibration and/or test standards and related methods and protocols assembled to satisfy the unique needs for accreditation in a field of testing or calibration. NVLAP accredits public and private laboratories based on evaluation of their technical qualifications and competence to carry out specific calibrations or tests. This Directory of laboratories is published annually and lists the name, address, contact person, phone and fax numbers, e-mail and URL addresses (if available), accreditation renewal date, and scope of accreditation for each laboratory.
NTIS

Laboratories; Ionizing Radiation; Electromagnetism; Directories; Calibrating

20000069790 NASA Lewis Research Center, Cleveland, OH USA

Nondestructive Superresolution Imaging of Defects and Nonuniformities in Metals, Semiconductors, Dielectrics, Composites, and Plants Using Evanescent Microwaves

Tabib–Azar, M., Case Western Reserve Univ., USA; Pathak, P. S., Case Western Reserve Univ., USA; Ponchak, G., NASA Lewis Research Center, USA; LeClair, S., Air Force Research Lab., USA; Review of Scientific Instruments; June 1999; ISSN 0034-6748; Volume 70, No. 6, pp. 2783-2792; In English

Contract(s)/Grant(s): RTOP 632-6E-51; Copyright; Avail: Issuing Activity

We have imaged and mapped material nonuniformities and defects using microwaves generated at the end of a microstripline resonator with 0.4 micrometer lateral spatial resolution at 1 GHz. Here we experimentally examine the effect of microstripline substrate permittivity, the feedline-to-resonator coupling strength, and probe tip geometry on the spatial resolution of the probe. Carbon composites, dielectrics, semiconductors, metals, and botanical samples were scanned for defects, residual stresses, subsurface features, areas of different film thickness, and moisture content. The resulting evanescent microwave probe (EMP) images are discussed. The main objective of this work is to demonstrate the overall capabilities of the EMP imaging technique as well as to discuss various probe parameters that can be used to design EMPs for different applications.
Author

Defects; Evanescence; Nonuniformity; Microwave Probes; Semiconductors (Materials); Composite Materials; Dielectrics; Plants (Botany); Metals

20000069796 National Inst. of Standards and Technology, Materials Reliability Div., Boulder, CO USA

Recommended Practice: Installing, Maintaining, and Verifying Your Charpy Impact Machine. Materials Reliability Series

Vigliotti, D. P., National Inst. of Standards and Technology, USA; Siewert, T. A., National Inst. of Standards and Technology, USA; McCowan, C. N., National Inst. of Standards and Technology, USA; Mar. 2000; 28p; In English

Report No.(s): PB2000-105224; NIST/TN-1500-8; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The quality of the data developed by pendulum impact machines depends on how well the machines are installed, maintained, and verified. From evaluation of the absorbed energies and the fractured specimens, we attempt to deduce the origin of energies that are outside the ranges permitted by ASTM Standard E 23 (Standard Test Methods for Notched Bar Impact Testing of Metallic Materials), and report these observations back to the machine owners. This recommended practice summarizes the bases for these observations, and hopefully will allow machines to be maintained at higher levels of accuracy. In addition, we provide details of the NIST verification program procedures and the production of the specimens.
NTIS

Charpy Impact Test; Maintainability; Installing; Mechanical Properties; Reliability Analysis

20000070418 NASA Marshall Space Flight Center, Huntsville, AL USA

Effect of Thermal Diffusivity on the Detectability of TNDE

Zhao, Junduo, University of Southern Illinois, USA; Chu, Tsuchin, University of Southern Illinois, USA; Russell, Samuel S., NASA Marshall Space Flight Center, USA; [2000]; 4p; In English; 9th; International Congress, 5-8 Jun. 2000, Orlando, FL, USA; Sponsored by Society for Experimental Mechanics, USA

Contract(s)/Grant(s): NGT8-52874; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The effect of thermal diffusively on the defect detectability in Carbon/Epoxy composite panels by transient thermography is presented in this paper. A series of Finite Element Models were constructed and analyzed to simulate the transient heat transfer phenomenon during Thermographic Non-destructive Evaluation (TNDE) of composite panels with square defects. Six common carbon fibers were considered. The models were built for composites with various combinations of fibers and volumetric ratios. Finite Element Analysis of these models showed the trends of the detectable range and the maximum thermal contrast versus the

thermal diffusivity of various composites. Additionally, the trends of defect size to depth ratio and the thermal contrast has been investigated.
Author
Detection; Epoxy Matrix Composites; Nondestructive Tests; Thermal Diffusivity; Thermography; Carbon Fibers

20000070455 NASA Langley Research Center, Hampton, VA USA
Probabilistic Risk Assessment: A Bibliography
July 2000; 83p; In English
Contract(s)/Grant(s): RTOP 284-30-10-03
Report No.(s): NASA/SP-2000-6112; NAS 1.21:6112; L-17991; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
    Probabilistic risk analysis is an integration of failure modes and effects analysis (FMEA), fault tree analysis and other techniques to assess the potential for failure and to find ways to reduce risk. This bibliography references 160 documents in the NASA STI Database that contain the major concepts, probabilistic risk assessment, risk and probability theory, in the basic index or major subject terms, An abstract is included with most citations, followed by the applicable subject terms.
Author
Data Bases; Failure Analysis; Probability Theory

20000070483 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Failure Engineering Study and Accelerated Stress Test Results for the Mars Global Surveyor Spacecraft's Power Shunt Assemblies
Gibbel, Mark, Jet Propulsion Lab., California Inst. of Tech., USA; Larson, Tim, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 20p; In English; Interpack 1999, 13-18 Jun. 1999, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    Due to a post launch failure of a part a new plan for the Mars Global Surveyor was developed. This new plan involved the addition of many deep thermal cycles to the Power Shunt Assemblies (PSA's). This new plan exceeds the previous acceptance cold level, and fatigue life on packaging design. This presentation reviews the experiments that were used to test the capabilities of the PSA to function in the new situation. It also reviews the analyses preformed to verify the most likely failure mechanism, and the likelihood that these failures would impact the new mission requirements.
CASI
Accelerated Life Tests; Fatigue Life; Mission Planning; Performance Tests; Failure Analysis; Reliability; Power Supply Circuits

20000070720 NASA Langley Research Center, Hampton, VA USA
Failure Modes and Effects Analysis (FMEA): A Bibliography
July 2000; 187p; In English
Contract(s)/Grant(s): RTOP 284-30-10-03
Report No.(s): NASA/SP-2000-6110; NAS 1.21:6110; L-17992; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche
    Failure modes and effects analysis (FMEA) is a bottom-up analytical process that identifies process hazards, which helps managers understand vulnerabilities of systems, as well as assess and mitigate risk. It is one of several engineering tools and techniques available to program and project managers aimed at increasing the likelihood of safe and successful NASA programs and missions. This bibliography references 465 documents in the NASA STI Database that contain the major concepts, failure modes or failure analysis, in either the basic index of the major subject terms.
CASI
Bibliographies; Failure Analysis; Failure Modes

20000073403 Civil Aviation Authority, Safety Regulation Group, Gatwick, UK
Operational Flight Data Monitoring: Why and How
Wright, David A., Civil Aviation Authority, UK; Monitoring and Intelligent Use of Data 'Turning Water into Wine': Proceedings; [2000], pp. 8.1 - 8.13; In English; See also 20000073398; Copyright; Avail: Issuing Activity
    It is well known that many accidents are the result of a combination of factors that individually are relatively harmless but, when brought together by chance or circumstance, provide a path to catastrophe. In aviation our aim is to prevent these factors occurring and to plan corrective action when they do occur. Hence reducing the total number of potentially risk bearing factors

present throughout the system. The key point in this risk management strategy is prior knowledge of all factors that actually occur in-service along with future possibilities.

Author

Management Planning; Accident Prevention

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

20000068439 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Shock Test of a Distribution Cabinet, Type DP 2J.1: Manufacturer Imtech
vanBragt, F. J., Building and Construction Research TNO, Netherlands; Jul. 30, 1999; 25p; In English; Original contains color illustrations
Contract(s)/Grant(s): A98/KM/134; TNO Proj. 006.93128/01.01
Report No.(s): TD-99-0092; Rept-99-CMC-R040; Copyright; Avail: Issuing Activity

Shock tests have been performed on a resiliently mounted distribution panel. The cabinet was mounted on wire rope mounts type K 16 180-02 S2. No damage has been established and no contact rumble was observed.

Author

Shock Tests; Damage; Panels

20000069362 Research Inst. of National Defence, Avd. foer Vapen och Skydd, Tumba, Sweden
Brief Review of Continuum Mechanical Material Models *Topical Report*
Fureby, C.; Dec. 22, 1998; 42p; In English
Report No.(s): PB2000-103077; FOA-R-99-01023-310-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Continuum mechanics is concerned with the mechanical behavior of matter on the macroscopic scale. It depresses the discrete nature of matter and treats the material as uniformly distributed throughout regions of space. It is therefore natural to define quantities as smooth functions over the material body. This definition is found to be reliable provided that we consider bodies whose dimensions are large compared with the characteristic lengths on the microscopic scale. Continuum models and others involve a utilization of the conservation equation of mass, the balance equation of momentum and energy, the second law of thermodynamics, and the principles of material frame indifference and symmetry. In addition, they involve linearizations of various types when characterizing the behavior of the material in terms of constitutive equations. A constitutive equation can be interpreted ideal material.

NTIS

Continuum Modeling; Mechanical Properties; Continuum Mechanics

20000069797 Stress Photonics, Inc., Madison, WI USA
Full Field Photoelastic Stress Analysis
Lesniak, Jon R., Inventor, Stress Photonics, Inc., USA; Apr. 25, 2000; 1p; In English
Patent Info.: Filed 2 Jun. 1997; US-Patent-6,055,053; US-Patent-Appl-SN-867475; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A structural specimen coated with or constructed of photoelastic material, when illuminated with circularly polarized light will, when stressed: reflect or transmit elliptically polarized light, the direction of the axes of the ellipse and variation of the elliptically light from illuminating circular light will correspond to and indicate the direction and magnitude of the shear stresses for each illuminated point on the specimen. The principles of this invention allow for several embodiments of stress analyzing apparatus, ranging from those involving multiple rotating optical elements, to those which require no moving parts at all. A simple polariscope may be constructed having two polarizing filters with a single one-quarter waveplate placed between the polarizing filters. Light is projected through the first polarizing filter and the one-quarter waveplate and is reflected from a sub-fringe birefringent coating on a structure under load. Reflected light from the structure is analyzed with a polarizing filter. The two polarizing

filters and the one-quarter waveplate may be rotated together or the analyzer alone may be rotated. Computer analysis of the variation in light intensity yields shear stress magnitude and direction.

Official Gazette of the U.S. Patent and Trademark Office

Stress Analysis; Photoelastic Materials; Shear Stress; Polarized Light; Luminous Intensity; Computer Techniques; Birefringent Coatings

20000070445 California Univ., San Diego, Dept. of Applied Mechanics and Engineering Sciences, La Jolla, CA USA

Deformation and Failure in Functionally Gradient Materials *Final Report, 30 Aug. 1993-30 Apr. 1999*

Gu, Pei, California Univ., San Diego, USA; Asaro, R. J., California Univ., San Diego, USA; Apr. 21, 2000; 84p; In English

Contract(s)/Grant(s): N00014-93-1-1164

Report No.(s): AD-A377901; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

Several aspects regarding the mechanical behavior of functionally graded materials have been investigated. In particular. the microstructure's effect of the failure initiation under thermal loading has been modeled by a computational micro-mechanics model. Cracks in various geometries and gradient variation forms have been studied and calibrated for testing these materials.

DTIC

Functionally Gradient Materials; Cracks; Failure; Plastic Deformation; Microstructure

20000070457 NASA Langley Research Center, Hampton, VA USA

A Historical Perspective on Dynamics Testing at the Langley Research Center

Horta, Lucas G., NASA Langley Research Center, USA; Kvaternik, Raymond G., NASA Langley Research Center, USA; May 2000; 25p; In English; Dynamics Specialists Conference, 5-6 Apr. 2000, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 522-32-21-02

Report No.(s): NASA/TM-2000-210295; NAS 1.15:210295; L-17989; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The history of structural dynamics testing research over the past four decades at the Langley Research Center of the National Aeronautics and Space Administration is reviewed. Beginning in the early sixties, Langley investigated several scale model and full-scale spacecraft including the NIMBUS and various concepts for Apollo and Viking landers. Langley engineers pioneered the use of scaled models to study the dynamics of launch vehicles including Saturn I, Saturn V, and Titan III. In the seventies, work emphasized the Space Shuttle and advanced test and data analysis methods. In the eighties, the possibility of delivering large structures to orbit by the Space Shuttle shifted focus towards understanding the interaction of flexible space structures with attitude control systems. Although Langley has maintained a tradition of laboratory-based research, some flight experiments were supported. This review emphasizes work that, in some way, advanced the state of knowledge at the time.

Author

Dynamic Structural Analysis; Dynamic Tests; Modal Response; Dynamic Response; Vibration Tests

20000070731 Institute of Industrial Technology TNO, Divisie Materiaaltechnologie, Eindhoven, Netherlands

Fatigue Resistance of 3 Coating Systems on Steel Substrate *Vermoeiingsmetingen Aan 3 Coatingsystemen*

Breen, Jan, Institute of Industrial Technology TNO, Netherlands; April 2000; 27p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): A98/KM/116; TNO Proj. 007.50080

Report No.(s): TNO-Div499.1158; TNO-2000-286; Copyright; Avail: Issuing Activity

This report describes and explains fatigue measurements and results obtained on coated steel tapered specimens. The specimens were milled and grid blasted before the coating systems under study were applied. The high solid coating systems, Sigma EP multiguard, Sigma BT and Universal THA, consisted of a primer and a top coat. The top coat was applied in two thicknesses, namely the recommended thickness and 3 times the recommended thickness. The frequency applied in fatigue was 0.2 Hz and the maximum strain about 1 %. The strain amplitude was varied. The fatigue experiments were performed after three ageing periods, namely 3 weeks at ambient temperature, three weeks at ambient followed by 6 weeks at 60 C and 3 weeks at ambient temperature followed by 6 months at 60 C. Microscopic surface analysis after the fatigue experiments showed only a few cracks in the areas subjected to the highest strain levels after the first and the second ageing period. However after the third ageing period, the critical strain level for crack initiation was reduced to 0.6-0.75 %. The third ageing period is probably still too mild for the ageing conditions met at the water line.

Author

Coatings; Fatigue (Materials); Steels; Fracture Strength; Crack Initiation

20000072426 Texas A&M Univ., Dept. of Mechanical Engineering, College Station, TX USA

Acquisition of a Hydraulic Press for Bulk Simple Shear *Final Report, 1 Mar. 1998-30 Jun. 1999*

Barber, Robert E.; Hartwig, K. T.; Jan. 24, 2000; 13p; In English

Contract(s)/Grant(s): F49620-98-1-0229; AF Proj. 3484

Report No.(s): AD-A377675; AFRL-SR-BL-TR-00-0183; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A 550 kip testing press was acquired by Texas A&M University during the period from April of 1998 through June of 1999. The primary function of the press is to aid in the equal channel angular extrusion (ECAE) process research currently underway in the Department of Mechanical Engineering. Secondary functions include materials testing, education in material deformation, and fabrication forming. The acquisition of the press has enhanced the research efforts in ECAE processing by providing a dedicated, convenient, efficient, and safe facility for a wide range of related experiments. The research related educational benefits are being recognized via several graduate student research projects. A plan for an undergraduate materials course to use the facility for an extrusion experiment is currently in the design and implementation phase.

DTIC

Hydraulic Equipment; Presses; Pressing (Forming); Extruding

20000073748 Electricite de France, Direction des Etudes et Recherches, Clamart, France

Three node cable element ensuring the continuity of the horizontal tension: clamp-cable element

Aufaure, M.; Dec. 31, 1996; 24p; In French; In English

Report No.(s): DE99-723877; EDF-97-NR-00035; No Copyright; Avail: Department of Energy Information Bridge

The horizontal tension (modulus of the tension vector horizontal component) of cables must be continuous at certain connections, for instance in the case of overhead electric lines, at the clamps anchoring them to suspension strings. The clamp-cable element models these connections. It comprises three nodes. The end ones are fixed on the cable. During iterative calculations involving this element, the intermediate node, connected to another structure, slides along the cable between the preceding two the position for which the horizontal tension is continuous. This element is non linear because of the large displacements its nodes may undergo. One gives the expressions of the internal forces at the nodes, of the horizontal tension continuity at the intermediate one and, by deriving them, on calculates the tangent stiffness matrix. The example of an electric line section with a dropper shows that a modelling comprising clamp-cable elements enables, in few iterations, to determine all the parameters required for the construction of the section, meeting a given value for one sag and verticality for the suspension strings.

NTIS

Transmission Lines; Tension

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see categories 41 through 48.

20000069359 Geological Survey, Water Resources Div., Richmond, VA USA

Water Resources Data for Virginia, Water Year 1999, Volume 2, Ground-Water Level and Ground-Water Quality Records
Annual Report

White, R. K.; Powell, E. D.; Jan. 2000; 368p; In English

Report No.(s): PB2000-102894; USGS/WDR/VA-99-2; No Copyright; Avail: National Technical Information Service (NTIS)

This report contains water levels at 279 observation wells and water quality at 120 wells.

NTIS

Water Quality; Water Resources; Hydrology

20000069360 Michigan Dept. of Natural Resources, Fisheries Div., Lansing, MI USA

Thermal Habitat Classification for Lower Michigan Rivers *Topical Report*

Wehrly, K. E.; Wiley, M. J.; Seelbach, P. W.; Sep. 01, 1999; 60p; In English

Report No.(s): PB2000-102985; No Copyright; Avail: National Technical Information Service (NTIS)

The authors developed a thermal classification for Lower Michigan rivers that characterizes the spatial variation in summer (July) temperatures in terms of both mean temperatures and temperature fluctuations. The authors used patterns of change in community composition, species richness, and abundance of key species to partition continuous gradients of mean temperature and temperature fluctuation to identify discrete thermal categories. The authors identified three mean temperature categories and

three temperature fluctuation categories. These categories were combined to create a 3 x 3 matrix with 9 discrete thermal regimes. Species distribution data were plotted on this 3 x 3 matrix to examine how selected species were distributed across thermal regimes. In order to quantify patterns of distribution and abundance, the authors calculated both the average density of a species was present. The authors also generated habitat suitability scores within each thermal regime for each species in order to identify appropriate thermal habitats for individual species.
NTIS
Habitats; Classifications; Water Temperature; Thermodynamic Properties

20000069361 Geological Survey, Water Resources Div., Denver, CO USA
Geomorphic and Sedimentologic Characteristics of Alluvial Reaches in the Black Canyon of the Gunnison National Monument, Colorado
Elliott, J. G.; Hammack, L. A.; 1999; 78p; In English
Report No.(s): PB2000-103010; USGS/WRI-99-4082; No Copyright; Avail: National Technical Information Service (NTIS)
     This report summarizes geomorphic, hydraulic, and sedimentologic data collected in two alluvial reaches of Black Canyon (BLCA) in 1990, 1994, and 1995 and hydrologic data recorded since the early 20th century. The objective of this study was to determine the hydraulic conditions and minimum streamflow necessary to entrain, or initiate the movement, of the sediment medium-particle size (d(sub 50)) of the alluvial stream banks and bars in selected areas of BLCA vulnerable to encroachment by riparian vegetation. The data and these findings will be used by the NPS to assess the sensitivity of the riparian corridor in BLCA to potential changes in the Gunnison River streamflow regime.
NTIS
Geomorphology; Sediments; Alluvium; Hydrology

20000069364 Geological Survey, Information Services Div., Denver, CO USA
Water Quality of Rob Roy Reservoir and Lake Owen, Albany County, and Granite Springs and Crystal Lake Reservoirs, Laramie County, Wyoming, 1997-1998 *Final Report*
Ogle, K. M.; Peterson, D. A.; Spillman, B.; Padilla, R.; 1999; 142p; In English
Report No.(s): PB2000-103113; WRI-99-4220; No Copyright; Avail: National Technical Information Service (NTIS)
     This report provides baseline water-quality data for four reservoirs--Rob Roy, Lake Owen, Granite Springs, and Crystal Lake. Specifically this report summarizes phytoplankton and profile data collected at a selected monitoring site in each reservoir over a summer season, selected physical, chemical and biological constituents for a single sample collected from the water column during the summer of 1997, and selected chemical constituents in composite samples of bottom sediment from each reservoir. The report is limited to the four reservoirs and to a general description of the water quality of the reservoirs. Due to unexpected opportunities, the project team was able to add winter, spring, and summer profiles for Granite Springs and Crystal Lake Reservoirs.
NTIS
Chemical Composition; Crystals; Phytoplankton; Water Quality; Lakes

20000069369 Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI USA
Limnological Monitoring on the Upper Mississippi River System, 1993-1996: Lake City Field Station. Long Term Resource Monitoring Program
Soballe, D. M.; Burdis, R.; Popp, W.; Oct. 1999; 158p; In English
Report No.(s): PB2000-103228; LTRMP-99-P003; No Copyright; Avail: National Technical Information Service (NTIS)
     The period of this report (1993-1996) includes a major revision of the LTRMP sampling design in 1993 that added randomization, broader spatial coverage, and increased monitoring of tributaries and locations that allow monitoring of material transport. Monitoring by the Lake City (Minnesota) Field Station shows water quality differences among the tributaries to Pools 4 and 5, spatial and temporal patterns within these pools, and the sediment and nutrient trapping effects of Lake Pepin, a natural impoundment of the Mississippi River.
NTIS
Limnology; Mississippi River (US); Spatial Distribution; Temporal Distribution; Water Quality

20000070724 NASA Goddard Space Flight Center, Greenbelt, MD USA
One-Dimensional Coupled Ecosystem-Carbon Flux Model for the Simulation of Biogeochemical Parameters at Ocean Weather Station P
Signorini, S., General Sciences Corp., USA; McClain, C., NASA Goddard Space Flight Center, USA; Christian, J., Universities

Space Research Association, USA; Wong, C. S., Institute of Ocean Studies, Canada; June 2000; 48p; In English
Contract(s)/Grant(s): RTOP 622-51-30
Report No.(s): NASA/TP-2000-209892; NAS 1.60:209892; Rept-2000-01898-0; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this Technical Publication, we describe the model functionality and analyze its application to the seasonal and interannual variations of phytoplankton, nutrients, pCO2 and CO2 concentrations in the eastern subarctic Pacific at Ocean Weather Station P (OWSP, 50 deg. N 145 deg. W). We use a verified one-dimensional ecosystem model, coupled with newly incorporated carbon flux and carbon chemistry components, to simulate 22 years (1958-1980) of pCO2 and CO2 variability at Ocean Weather Station P (OWS P). This relatively long period of simulation verifies and extends the findings of previous studies using an explicit approach for the biological component and realistic coupling with the carbon flux dynamics. The slow currents and the horizontally homogeneous ocean in the subarctic Pacific make OWS P one of the best available candidates for modeling the chemistry of the upper ocean in one dimension. The chlorophyll and ocean currents composite for 1998 illustrates this premise. The chlorophyll concentration map was derived from SeaWiFS data and the currents are from an OGCM simulation (from R. Murtugudde).
Author
Phytoplankton; Annual Variations; Biogeochemistry; Mathematical Models; Marine Chemistry; Environment Models; Carbon Dioxide Concentration

20000070752 Geological Survey, Water Resources Div., Northborough, MA USA
WTAQ: A Computer Program for Calculating Drawdowns and Estimating Hydraulic Properties for Confined and Water-Table Aquifers
Barlow, P. M.; Moench, A. F.; 1999; 88p; In English
Report No.(s): PB2000-106241; USGS/WRI-99-4225; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The computer program, WTAQ, calculates hydraulic-head drawdowns in a confined or water-table aquifer that result from pumping at a well of finite or infinitesimal diameter. The program is based on an analytical model of axial-symmetric ground-water flow in a homogeneous and anisotropic aquifer. The program allows for well-bore storage and well-bore skin at the pumped well and for delayed drawdown response at an observation well; by including these factors, it is possible to accurately evaluate the specific storage of a water-table aquifer from early-time drawdown data in observation wells and piezometers. For water-table aquifers, the program allows for either delayed or instantaneous drainage from the unsaturated zone. WTAQ calculates dimensionless or dimensional theoretical drawdowns that can be used with measured drawdowns at observation points to estimate the hydraulic properties of confined and water-table aquifers. Three sample problems illustrate use of WTAQ for estimating horizontal and vertical hydraulic conductivity, specific storage, and specific yield of a water-table aquifer by type-curve methods and by an automatic parameter-estimation method.
NTIS
Aquifers; Computer Programs; Ground Water; Water Tables; Hydrology Models

20000070763 National Science Foundation, Washington, DC USA
U.S. Antarctic Program, 1998-1999, *1998-1999*
Sep. 1998; 64p; In English
Report No.(s): PB2000-106077; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Contents include the following: U.S. Antarctic Program, 1998-1999; Biology and medical research; Long-term ecological research; Environmental research; Geology and geophysics; Glaciology; Ocean and climate studies; Aeronomy and astrophysics; and Technical projects.
NTIS
Antarctic Regions; Earth Sciences; Research

20000070840 Minnesota Univ., Water Resources Research Center, Saint Paul, MN USA
Effects of Reducing Nutrient Loads to Surface Waters within the Mississippi River Basin and the Gulf of Mexico. Topic 4 Report for the Integrated Assessment on Hypoxia in the Gulf of Mexico *Final Report*
Brezonik, P. L.; Bierman, V. J.; Alexander, R.; Anderson, J.; Barko, J.; May 1999; 156p; In English
Report No.(s): PB2000-104027; No Copyright; Avail: National Technical Information Service (NTIS)

The overall goal of this assessment was to evaluate the effects of nutrient-source reductions that may be implemented in the Mississippi River Basin (MRB) to reduce the problem of low oxygen conditions (hypoxia) in the nearshore Gulf of Mexico. Such source reductions would affect the quality of surface waters--streams, rivers, and reservoirs--in the drainage basin itself, as well

as nearshore Gulf waters. The task group's work was divided into addressing the effects of nutrient-source reductions on: (1) surface waters in the MRB and (2) hypoxia in the Gulf of Mexico.
NTIS
Water Pollution; Hypoxia; Mississippi River (US); River Basins; Gulf of Mexico; Pollution Control; Surface Water; Minerals; Environment Effects; Nearshore Water

20000070844 Texas Univ., Center for Transportation Research, Austin, TX USA
GIS-Based System of Hydrologic and Hydraulic Applications for Highway Engineering *Topical Report, Sep. 1998 - Aug. 1999*
Olivera, F.; Maidment, D.; Oct. 1999; 184p; In English
Report No.(s): PB2000-104073; FHWA/TX-00/1738-6; No Copyright; Avail: National Technical Information Service (NTIS)
     In this research project, a Geographic Information Systems (GIS) has been developed to assist in the design of highway drainage facilities by utilizing hydrologic spatial data to calculate the input parameters for standard hydrologic software packages. The GIS reduces the analysis time and improves the analysis accuracy by integrating digital spatial data that describes the watershed of interest with hydrologic theory. This Final Report presents a summary of the results obtained throughout the duration of this three-year project.
NTIS
Geographic Information Systems; Highways; Mechanical Engineering; Hydrology

20000073301 NASA Goddard Space Flight Center, Greenbelt, MD USA
Global Geophysical Fluids Center of IERS *Progress Report*
Chao, Benjamin F., NASA Goddard Space Flight Center, USA; Dehant, V., NASA Goddard Space Flight Center, USA; Gross, R. S., NASA Goddard Space Flight Center, USA; Ray, R. D., NASA Goddard Space Flight Center, USA; Salstein, D. A., NASA Goddard Space Flight Center, USA; Watkins, M., NASA Goddard Space Flight Center, USA; Wilson, C. R., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; 24th, 25-29 Apr. 2000, Nice, France; Sponsored by European Geophysical Society, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only
     The Global Geophysical Fluids Center (GGFC) and its seven Special Bureaus (SB, for Atmosphere, Oceans, Tides, Hydrology, Mantle, Core and Gravity/Geocenter) were establishes by the International Earth Rotation Service in 1998, to support global geodynamic research. Mass transports in the geophysical fluids of the Earth system will cause observable geodynamic effects on a broad time scale.These include (1) variations in the solid Earth's rotation (in length-of-day and polar motion/nutation) via the conservation of angular momentum and effected by torques at the fluid-solid Earth interface; (2) changes in the global gravitational field according to Newton's gravitational law; and (3) motion in the center of mass of the solid Earth relative to that of the whole Earth ("geocenter") via the conservation of linear momentum. These minute signals have become observable by space geodetic techniques, primarily VLBI, SLR, GPS, and DORIS, and new exciting data will be available by space gravity, altimetry, SAR, and magnetic missions. In this sense the precise space geodetic techniques have become effective means of remote sensing of global mass transports. The GGFC and its SBs have the responsibility of supporting, facilitating, and providing services to the worldwide research community in the related research areas. We compute, analyze, compare, archive, and disseminate the time series of the angular momenta and the related torques, gravitational coefficients, and geocenter shift for all geophysical fluids, based on global observational data, and/or products from state-of-the-art models some of which assimilate such data. The computed quantities, algorithm and data formats are standardized. This paper reviews our activities, reports the status, and looks forward into the future.
Author
Geophysical Fluids; Geodynamics; Time Series Analysis; Gravitational Fields; Global Positioning System; Atmospheric Tides; Earth Rotation

20000073810 Potsdam-Inst. fuer Klimafolgenforschung, Potsdam, Germany
CLIMBER-2: a climate system model of intermediate complexity, Part 1, Model description and performance for present climate
Petoukhov, V.; Ganopolski, A.; Brovkin, V.; Claussen, M.; Eliseev, A.; Feb. 28, 1998; 44p; In English
Report No.(s): DE99-715839; PIK-35; No Copyright; Avail: Department of Energy Information Bridge
     A 2.5-dimensional climate system model of intermediate complexity CLIMBER-2 and its performance for present climate conditions are presented. The model consists of modules describing atmosphere, ocean, sea ice, land surface processes, terrestrial vegetation cover, and global carbon cycle. The modules interact (on-line) through the fluxes of momentum, energy, water and carbon. The model has a coarse spatial resolution, allowing nevertheless to capture the major features of the Earth's geography.

The model describes temporal variability of the system on seasonal and longer time scales. Due to the fact that the model does not employ any type of flux adjustment and has fast turnaround time, it can be used for study of climates significantly different from the present one and allows to perform long-term (multimillennia) simulations. The constraints for coupling the atmosphere and ocean without flux adjustment are discussed. The results of a model validation against present climate data show that the model successfully describes the seasonal variability of a large set of characteristics of the climate system, including radiative balance, temperature, precipitation, ocean circulation and cryosphere.

NTIS

Climate Models; Climatology; Meteorology

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis or remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photographs. For instrumentation see 35 Instrumentation and Photography.

20000068442 Cranfield Univ., Coll. of Aeronautics, Bedford, UK

Orwell Demonstrator Summary of the Group Design Project MSc in Astronautics and Space Engineering 1998/99 Cranfield University

Hobbs, S. E., Cranfield Univ., UK; Turner, Ray, Rutherford Appleton Lab., UK; February 2000; 70p; In English

Report No.(s): COA-Rept-9918; ISBN 1-86194-049-1; Copyright; Avail: Issuing Activity

ORWELL Demonstrator, the group design project for the MSc in Astronautics and Space Engineering 1998/99, is a demonstrator for an Earth observation (EO) system whose objective is to provide a commercial service complementing current and planned EO systems. Rapid response and low cost are the main mission drivers. The baseline developed uses a constellation of twelve satellites in four planes for the full system, and one of these four planes (with three satellites) for the demonstrator. The payload proposed is a lightweight low-power synthetic aperture radar (SAR). The SAR is technologically demanding but offers the possibility of all-weather 24-hour imaging which is critical for fast-response imaging. A standard minisatellite bus (the SpectrumAstro SA200) is proposed for use in the mission. The report summarizes the results of the project and includes executive summaries from all team members. Further information and summaries of the full reports are available from the College of Aeronautics, Cranfield University.

Author

Remote Sensing; Proving; Imaging Techniques; Earth Observations (From Space)

20000068524 Naval Postgraduate School, Monterey, CA USA

Computer-Aided Recognition of Man-Made Structures in Aerial Photographs

Cardoso, Luiz A.; Dec. 1999; 161p; In English

Report No.(s): AD-A376824; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Aerial image acquisition systems are producing more data than can be analyzed by human experts. Most of the images produced by remote sensing satellites, including military ones, never get seen or inspected. In this work, automated detection and recognition of buildings in aerial photos is explored. Connectivity analysis is performed on graphs derived from line segment representations of the original images, obtained with the use of the Radon Transform. The model is experimentally validated using 2-meter panchromatic aerial photographs from the National Aerial Photography Program (NAPP), which provide a marginally adequate resolution for the recognition of small buildings.

DTIC

Aerial Photography; Remote Sensing; Pattern Recognition; Neural Nets; Target Recognition

20000068539 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Classification of JERS-1 Image Mosaic of Central Africa Using A Supervised Multiscale Classifier of Texture Features

Saatchi, Sassan, Jet Propulsion Lab., California Inst. of Tech., USA; DeGrandi, Franco, Joint Research Centre of the European Communities, Italy; Simard, Marc, Jet Propulsion Lab., California Inst. of Tech., USA; Podest, Erika, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 3p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper, a multiscale approach is introduced to classify the Japanese Research Satellite-1 (JERS-1) mosaic image over the Central African rainforest. A series of texture maps are generated from the 100 m mosaic image at various scales. Using a quadtree model and relating classes at each scale by a Markovian relationship, the multiscale images are classified from course

to finer scale. The results are verified at various scales and the evolution of classification is monitored by calculating the error at each stage.
Author
Africa; Classifications; Mosaics; Rain Forests; Image Classification

20000068965 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
First Results From the GeoSAR Mapping Instrument
Hensley, Scott, Jet Propulsion Lab., California Inst. of Tech., USA; Wheeler, Kevin, Jet Propulsion Lab., California Inst. of Tech., USA; Berkun, Andy, Jet Propulsion Lab., California Inst. of Tech., USA; Brown, Walt, Jet Propulsion Lab., California Inst. of Tech., USA; Chapin, Elaine, Jet Propulsion Lab., California Inst. of Tech., USA; Freedman, Adam, Jet Propulsion Lab., California Inst. of Tech., USA; Hamilton, Gary, Jet Propulsion Lab., California Inst. of Tech., USA; Kroger, Peter, Jet Propulsion Lab., California Inst. of Tech., USA; Michel, Charles Le. Thierry, Jet Propulsion Lab., California Inst. of Tech., USA; Moller, Delwyn, Jet Propulsion Lab., California Inst. of Tech., USA; Mar. 23, 1999; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
     Geosynchronous Synthetic Aperture Radar (GeoSAR) is a consortium project consisting of The Jet Propulsion Laboratory (JPL), Calgis (a small GIS company based in Fresno, CA) and the California Department of Conservation with funding provided by Defense Research Projects Agency (DARPA) started in November 1996. The two main objectives of the GeoSAR Program are: 1) to develop a state of the art dual frequency interferometric radar mapping instrument capable of mapping the true ground surface height beneath the vegetation canopy; and 2) To transition this mapping technology to a commercial company, Calgis. JPL, the technical lead, has the following program deliverables at program completion in November 1999 include radar design and radar hardware for X-band (3 cm) and P-band (83 cm) radars, processor software, hardware and documentation, and calibrated X-band radar.
Derived from text
Synthetic Aperture Radar; Radar Equipment; Interferometry; Systems Analysis; Radar Maps; Canopies (Vegetation)

20000069792 Lunar and Planetary Inst., Houston, TX USA
Slate Islands, Lake Superior, Canada: A mid-size, Complex Impact Structure
Dressler, B. O., Lunar and Planetary Inst., USA; Sharpton, V. L., Lunar and Planetary Inst., USA; Copeland, P., Houston Univ., USA; 1999; 16p; In English; 2nd; Large Meteorite Impacts and Planetary Evolution, 1999, Boulder, CO, USA; Original contains color illustrations
Contract(s)/Grant(s): NASw-4574
Report No.(s): LPI-Contrib-945; Special-Paper-339; Copyright; Avail: Issuing Activity
     The target rocks of the 30-32-km diameter Slate Islands impact structure in northern Lake Superior, Canada, are Archean supracrustal and igneous rocks and supracrustal Proterozoic rocks. Shatter cones, pseudotachylites, impact glasses, and microscopic shock metamorphic features were formed during the contact and compression phase of the impact process, followed, during excavation and central uplift, by polymict, clastic matrix breccias in the uplifted target, and by allogenic fall-back breccias (suevite and bunte breccia). Monomict, autoclastic breccias were mainly observed on Mortimer Island and the other outlying islands of the archipelago and were probably generated relatively late in the impact process (central uplift and/or crater modification). The frequency of low index planar shock metamorphic features in quartz was correlated with results from shock experiments to estimate shock pressures experienced by the target rocks. The resulting shock attenuation plan across the archipelago is irregular, probably because the shock wave did not expand from a point or spherical source, and because of the destruction of an originally more regular shock attenuation plan during the central uplift and crater modification stages of the impact process. No impact melt rock bodies have been positively identified on the islands. An impact melt may be present in the annular trough around the islands, though and-based on a weighted mixture of target rocks-may have an intermediate-mafic composition. No such impact melt was found on the archipelago. An Ar-40-Ar-39 release spectrum of a pseudotachylite provides an age of about 436 Ma for the impact structure, substantiating age constraints based on various stratigraphic considerations.
Author
Impact Melts; Lake Superior; Igneous Rocks; Shatter Cones; Sedimentary Rocks; Shock Waves; Metamorphism (Geology); Meteorite Craters

20000070365 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Remote Sensing of Volcanic Clouds: Sulfur Gases and Plume Top Topography
Crisp, Joy A., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 11; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

New absorption line parameters for H2S were published and submitted to the Gestion et Etude des Informations Spectroscopiques Atmospheriques (GEISA) and high resolution transmission molecular absorption (HITRAN) databases. These new absorption line parameters will make it possible to use observations from the future Tropospheric Emission Spectrometer (TES) instrument [Earth Observing System (EOS) Chemistry Mission (CHEM) platform] to make more accurate H2S measurements if it observes an H2S-rich volcanic cloud. H2S is the second most abundant volcanic sulfur gas, and like SO2, it also converts to H2SO4 aerosols and can have a climate impact. A paper on the Moderate-resolution Imaging-Spectroradiometer (MODIS) SO2 alert is being revised. New aspects in the revision include verification of the SO2 alert during the EOS mission; factors affecting SO2 detection at thermal infrared, ultraviolet, and microwave wavelengths; radiative transfer tests; more description of satellite instruments; and thermal surface alert installed for MODIS. Her research involves the use of remote sensing to generate maps of plume top altitude. This parameter is important for models of volcanic eruption, aircraft hazards, and climate impact. The topographic shape of the top surface of a volcanic plume can provide information necessary to understand the physics controlling the injection and dispersal of a volcanic plume in the atmosphere. Glaze et al. describe the application of a photoclinometric technique to volcanic plumes. The software algorithm has been improved to account for more general plume and illumination geometries and for easily extracting position information directly from Advanced Very High-Resolution Radiometer (AVHRR) level 1B data. Testing of the algorithm has focused on acquiring AVHRR data for a variety of volcanic plumes in an effort to identify problems with the software as well as model sensitivities. The plumes chosen were erupted from volcanoes at a variety of latitudes, at different times of day, and in different seasons. Another important issue that is being investigated is the importance of plume opacity. A diagram illustrates the method for deriving phi, the angle a wind-blown plume makes with the horizontal, in the direction perpendicular to the remote sensing scan. A figure shows a sample output of the algorithm, a wire mesh map of plume top topography. Additional information is contained in the original.
Author
Dispersing; Hydrogen Sulfide; Plumes; Sulfur; Sulfuric Acid; Volcanoes; Wind Effects; Remote Sensing

20000070369 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Satellite Altimetry, Ocean Circulation, and Data Assimilation
Fu, Lee–Lueng, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 15; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Ocean circulation is a critical factor in determining the Earth's climate. Satellite altimetry has been proven a powerful technique for measuring the height of the sea surface for the study of global ocean circulation dynamics. A major objective of my research is to investigate the utility of altimeter data for ocean circulation studies. The 6 years' data record of TOPEX/POSEIDON have been analyzed to study the spatial and temporal characteristics of large-scale ocean variability. A major result obtained in 1998 is the discovery of large-scale oscillations in sea level with a period of 25 days in the Argentine Basin of the South Atlantic Ocean (see diagram). They exhibit a dipole pattern with counterclockwise rotational propagation around the Zapiola Rise (centered at 45S and 317E), a small seamount in the abyssal plain of the basin. The peak-to-trough amplitude is about 10 cm over a distance of 500-1000 km. The amplitude of these oscillations has large seasonal-to-interannual variations. The period and rotational characteristics of these oscillations are remarkably similar to the observations made by two current meters deployed near the ocean bottom in the region. What TOPEX/POSEIDON has detected apparently are manifestations of the movement of the entire water column (barotropic motion). The resultant transport variation is estimated to be about 50 x 10(exp 6) cubic M/S, which is about 50% of the total water transport in the region. Preliminary calculations suggest that these oscillations are topographically trapped waves. A numerical model of the South Atlantic is used to investigate the nature of and causes for these waves. A very important property of sea surface height is that it is directly related to the surface geostrophic velocity, which is related to deep ocean circulation through the density field. Therefore altimetry observations are not only useful for determining the surface circulation but also for revealing information about the deep ocean. Another objective of my research is to investigate the extent of information one can infer about the deep ocean from altimetric observations. The approach is data assimilation by ocean models. The objective is to develop a modeling/data assimilation system that will produce estimates of the 3-dimensional state of the ocean for the entire duration of the TOPEX/POSEIDON Mission.
Author
Mathematical Models; Ocean Bottom; Ocean Currents; Ocean Dynamics; Ocean Models; Oceanography

20000070370 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Satellite Data Assimilation
Fukumori, Ichiro, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 16; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Satellite altimetry provides the only routine observation of a dynamic variable of the global ocean. For instance, measurements from the TOPEX/POSEIDON altimeter have provided dramatic basin-wide images of the space-time evolution of sea level associated with the 1997-98 El Nino event. The nature of large-scale ocean circulation is being studied that underlies such sea level changes measured by satellite altimetry. to first approximation, properties of large-scale (order 1000 km and larger) sea level variability is latitudinally dependent. An analysis using a general circulation model shows that sea level changes are largely due to wind-driven baroclinic (depth dependent) circulation in the tropics (within 20 degrees of the equator), but are primarily due to the expansion and contraction of near surface water in temperate latitudes (between 20 deg. and 40 deg.) forced by seasonal heating and cooling. In contrast, wind-driven barotropic (depth independent) circulation dominates sea level variability in high latitudes (40 deg. and higher) characterized by periods that are as short as a few days. The presence of such inhomogeneity and the significance of high-frequency, large-scale sea level changes had not been fully recognized prior to this study, and are summarized in Fukumori et al. Numerical models provide theoretical relationships among properties that can be inverted using observations so as to estimate the entire state of the ocean, including properties that are otherwise difficult to measure remotely. The process is data assimilation. An approximate Kalman filter and smoother have been devised to assimilate three years of TOPEX/POSEIDON sea level data into a global ocean general circulation model. The figure below demonstrates the skill of the assimilation, and shows the altimeter assimilated estimate being in closer agreement than the simulation is with independent in situ measurements of subsurace temperature and velocity, consistent with formal uncertainty estimates. Results from this study have been summarized and submitted for publication. The study demonstrates the feasibility of global ocean data assimilation and illustrates applications in monitoring and understanding of processes controlling the evolution of the ocean. Additional information is contained in the original.
Author
Atmospheric General Circulation Models; Mathematical Models; Ocean Models; Satellite Altimetry; Surface Water; Satellite Observation; Meteorological Satellites; Data Reduction

20000070374 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Elevation Change of the Southern Greenland Ice Sheet from Satellite Radar Altimeter Data
Haines, Bruce J., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 20; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Long-term changes in the thickness of the polar ice sheets are important indicators of climate change. Understanding the contributions to the global water mass balance from the accumulation or ablation of grounded ice in Greenland and Antarctica is considered crucial for determining the source of the about 2 mm/yr sea-level rise in the last century. Though the Antarctic ice sheet is much larger than its northern counterpart, the Greenland ice sheet is more likely to undergo dramatic changes in response to a warming trend. This can be attributed to the warmer Greenland climate, as well as a potential for amplification of a global warming trend in the polar regions of the Northern Hemisphere. In collaboration with Drs. Curt Davis and Craig Kluever of the University of Missouri, we are using data from satellite radar altimeters to measure changes in the elevation of the Southern Greenland ice sheet from 1978 to the present. Difficulties with systematic altimeter measurement errors, particularly in intersatellite comparisons, beset earlier studies of the Greenland ice sheet thickness. We use altimeter data collected contemporaneously over the global ocean to establish a reference for correcting ice-sheet data. In addition, the waveform data from the ice-sheet radar returns are reprocessed to better determine the range from the satellite to the ice surface. At JPL, we are focusing our efforts principally on the reduction of orbit errors and range biases in the measurement systems on the various altimeter missions. Our approach emphasizes global characterization and reduction of the long-period orbit errors and range biases using altimeter data from NASA's Ocean Pathfinder program. Along-track sea-height residuals are sequentially filtered and backwards smoothed, and the radial orbit errors are modeled as sinusoids with a wavelength equal to one revolution of the satellite. The amplitudes of the sinusoids are treated as exponentially-correlated noise processes with a time-constant of six days. Measurement errors (e.g., altimeter range bias) are simultaneously recovered as constant parameters. The corrections derived from the global ocean analysis are then applied over the Greenland ice sheet. The orbit error and measurement bias corrections for different missions are developed in a single framework to enable robust linkage of ice-sheet measurements from 1978 to the present. In 1998, we completed our re-evaluation of the 1978 Seasat and 1985-1989 Geosat Exact Repeat Mission data. The estimates of ice thickness over Southern Greenland (south of 72N and above 2000 m) from 1978 to 1988 show large regional variations (+/-18 cm/yr), but yield an overall rate of +1.5 +/- 0.5 cm/yr (one standard error). Accounting for systematic errors, the estimate may not be significantly different from the null growth rate. The average elevation change from 1978 to 1988 is too small to assess whether the Greenland ice sheet is undergoing a long-term change.
Author
Climate Change; Global Warming; Greenland; Ice; Ocean Surface; Polar Regions

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GPS Altimetry

The advent of satellite altimetry has greatly improved our ability to observe global ocean circulation. However, the swath of a single, nadir-viewing satellite altimeter is only a few km and the track spacing is several hundred km to resolve the two-dimensional structure of ocean eddies. Our goal is to increase spatial and temporal coverage by monitoring Global Positioning System (GPS) signals reflected from the ocean. A constellation of spacecraft would each carry a GPS receiver capable of recording 8 reflections simultaneously. The reflections are well distributed in azimuth and elevation and can be tracked continuously while the satellite is in view, and another is then acquired, as illustrated below. The diagram depicts a new approach at altimetry measurements where ocean surface reflected GPS signals are simultaneously tracked and processed in a GPS flight receiver in space. The reflected GPS signals from the ocean must be compared precisely with the direct GPS signals in order to infer the characteristics of the ocean from the combined data set. Understanding the features and accuracy of GPS altimetry measurement is crucial to establishing its suitability for oceanography. Preliminary work has enabled us to theoretically model the signal output of the correlator for a variety of system parameters such as wind speed (sea roughness), receiver height, incidence angle, receiver range and Doppler filter bandwidth and antenna gain. Expected signal-to-noise ratio has been estimated from which we have inferred, to a first approximation, the basic receiver gain requirements for a space-based altimeter and the expected range raw error. In 1998, work on a different task led to the extraction of the first reflected GPS signal observed from a spaceborne receiver during the 1995 Space Transportation System-68 (STS-68) Shuttle Radar Laboratory-2 (SRL-2) high resolution synthetic aperture radar mission. Good comparisons with our signal models have been obtained. Having established that only modest signal-to-noise ratios are obtainable unless very high gain antennas are used, we expect that single measurements might not provide an estimate of sea state parameters as accurate as that obtainable with traditional remote sensing instruments, if costs are limited. Therefore spatial and temporal averaging of many measurements is required. Since the receiving satellite tracks do not repeat, measurements in a given area will be used to refine the local solution as a function of time, and will define the spatial resolution. In order to make this instrument viable in space, we need to detect and process many scattered signals. In 1998 we made a first step at understanding what configurations of antenna gain and orientations capture the largest number of viable signals to be used in the subsequent spatial/temporal averaging process. Additional information is contained in the original.
Author
Global Positioning System; Ocean Currents; Ocean Dynamics; Ocean Surface; Satellite Altimetry; Oceans

The Ionosphere and Ocean Altimetry

The accuracy of satellite-based single-frequency radar ocean altimeters benefits from calibration of the total electron content (TEC) of the ionosphere below the satellite. Data from the global network of Global Positioning System (GPS) receivers provides timely, continuous, and globally well-distributed measurements of ionospheric electron content. We have created a daily automated process called Daily Global Ionospheric Map (Daily-GIM) whose primary purpose is to use global GPS data to provide ionospheric calibration data for the Geosat Follow-On (GFO) ocean altimeter. This process also produces an hourly time-series of global maps of the electron content of the ionosphere. This system is designed to deliver "quick-look" ionospheric calibrations within 24 hours with 90+% reliability and with a root-mean-square accuracy of 2 cm at 13.6 GHz. In addition we produce a second product within 72 hours which takes advantage of additional GPS data which were not available in time for the first process. The diagram shows an example of a comparison between TEC data from the Topographic Experiment (TOPEX) ocean altimeter and Daily-GIM. TEC are displayed in TEC units, TECU, where 5 TECU is 1 cm at 13.6 GHz. Data from a single TOPEX track is shown. Also shown is the Bent climatological model TEC for the track. Although the GFO satellite is not yet in its operational mode, we have been running Daily-GIM reliably (much better than 90%) with better than 2-cm accuracy (based on comparisons against TOPEX) for several months. When timely ephemeris files for the European Remote Sensing Satellite 2 (ERS-2) are available, daily ERS-2 altimeter ionospheric calibration files are produced. When GFO ephemeris files are made available to us, we produce GFO ionosphere calibration files. Users of these GFO ionosphere calibration files find they are a great improvement over the alternative International Reference Ionosphere 1995 (IRI-95) climatological model. In addition, the TOPEX orbit determination team at JPL has been using the global ionospheric maps to calibrate the single frequency GPS data from the TOPEX receiver,

and report highly significant improvements in the ephemeris. The global ionospheric maps are delivered daily to the International GPS Service (IGS), making them available to the scientific community. Additional information is contained in the original.
Author
Global Positioning System; Ionospheric Electron Density; Satellite Observation; Calibrating

20000070387 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Observations of Land Surface Variability Using Passive Microwave Sensing
Njoku, Eni G., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 33; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

   Understanding the global variability of land surface wetness (soil moisture), skin temperature, and related surface fluxes of heat and moisture is key to assessing the importance of the land surface in influencing climate. The feasibility of producing model estimates of these quantities is being studied as part of the International Satellite Land Surface Climatology Project (ISLSCP) Global Soil Wetness Project (GSWP). In the GSWP approach, meteorological observations and analyses are used to drive global circulation models. Satellite measurements can provide independent estimates of key land surface parameters that are needed for initializing and validating the climate models and for monitoring long-term change. Satellite observations of the land surface can also be assimilated into soil models to estimate moisture in the root zone. In our research, passive microwave satellite data recorded during 1978-1987 from the Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) are being used to examine spatial and temporal trends in surface soil moisture, vegetation, and temperature. These data include observations at C and X bands (6.6 and 10.7 GHz), which are not available on the current Special Sensor Microwave/Imager (SSM/I) and are precursors to data that will become available from the Advanced Microwave Scanning Radiometer (AMSR) on Advanced Earth Observing Satellite (ADEOS-II) and Earth Observing System (EOS) PM1 in the year 2000. A chart shows a time-series of SMMR-derived surface temperature, T-e and surface soil moisture M, retrieved on a 0.5 deg x 0.5 deg grid and further averaged over a 4 deg x 10 deg study region in the African Sahel. Also shown are National Center for Environmental Prediction (NCEP) model outputs of surface temperature, T-sfc, and soil wetness, Soil-w. The variables have been scaled to have similar dynamic ranges on the plots. The NCEP data from the NCEP Reanalysis Project are monthly averages on a 2.5 deg x 2.5 deg grid averaged over the 4 deg x 10 deg study area. Comparisons of SMMR retrievals with forecast model output show the potential of the satellite data for validating model output and monitoring long-term trends. Continuing work will extend these results to other regions to validate the retrievals more quantitatively. In preparation for the launch of AMSR, field experiments are planned in collaboration with the Global Energy and Water Cycle Experiment (GEWEX) Coordinated Enhanced Observing Period (CEOP) experiments to evaluate the satellite-derived soil moisture measurements and to demonstrate their usefulness for land surface hydrology and climate. Additional information is contained in the original.
Author
Climatology; Earth Surface; Moisture Content; Satellite Observation; Soil Moisture; Surface Temperature

20000070442 Arizona Univ., Optical Sciences Center, Tucson, AZ USA
Topics in Unconventional Imagery *Final Report, 10 Sep. 1998-31 Oct. 1999*
Frieden, B. R.; Barraza–Felix, Sergio; Apr. 12, 2000; 43p; In English
Contract(s)/Grant(s): F49620-98-1-0228
Report No.(s): AD-A377848; AFRL-SR-BL-TR-00-0180; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

   A new approach for digitally reducing the presence of random atmospheric turbulence in imagery was developed. This
DTIC
Atmospheric Turbulence; Satellite Imagery; Imaging Techniques; Atmospheric Correction

20000070458 NASA Goddard Space Flight Center, Greenbelt, MD USA
LANDSAT 7 Science Data Processing: An Overview
Schweiss, Robert J., NASA Goddard Space Flight Center, USA; Daniel, Nathaniel E., Computer Sciences Corp., USA; Derrick, Deborah K., Computer Sciences Corp., USA; [2000]; 10p; In English; SPIE Proceedings, 24-28 Apr. 2000, Orlando, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

   The LANDSAT 7 Science Data Processing System, developed by NASA for the LANDSAT 7 Project, provides the science data handling infrastructure used at the Earth Resources Observation Systems (EROS) Data Center (EDC) LANDSAT Data Handling Facility (DHF) of the USA Department of Interior, United States Geological Survey (USGS) located in Sioux Falls,

South Dakota. This paper presents an overview of the LANDSAT 7 Science Data Processing System and details of the design, architecture, concept of operation, and management aspects of systems used in the processing of the LANDSAT 7 Science Data. Author

LANDSAT 7; Earth Resources; Geological Surveys; Satellite Imagery; Data Processing

20000072447 NASA Goddard Space Flight Center, Greenbelt, MD USA

Thermal Performance of LANDSAT-7 ETM+ Instruments During First Year in Flight

Choi, Michael K., NASA Goddard Space Flight Center, USA; [2000]; 11p; In English; 35th; 35th Intersociety Energy Conversion Engineering Conference, 24-27 Jul. 2000, Las Vegas, NV, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2000-2902; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

LANDSAT-7 was successfully launched into orbit on April 15, 1999. After devoting three months to the t bakeout and cooldown of the radiative cooler, and on- t orbit checkout, the Enhanced Thematic Mapper Plus (ETM+) began the normal imaging phase of the mission in mid-July 1999. This paper presents the thermal performance of the ETM+ from mid-July 1999 to mid-May 2000. The flight temperatures are compared to the yellow temperature limits, and worst cold case and worst hot case flight temperature predictions in the 15-orbit mission design profile. The flight temperature predictions were generated by a thermal model, which was correlated to the observatory thermal balance test data. The yellow temperature limits were derived from the flight temperature predictions, plus some margins. The yellow limits work well in flight, so that only several minor changes to them were needed. Overall, the flight temperatures and flight temperature predictions have good agreement. Based on the ETM+ thermal vacuum qualification test, new limits on the imaging time are proposed to increase the average duty cycle, and to resolve the problems experienced by the Mission Operation Team. Author

Thematic Mappers (LANDSAT); Imaging Techniques; Temperature Measurement; Thermal Vacuum Tests

20000073224 NASA Goddard Space Flight Center, Greenbelt, MD USA

Using Laser Altimetry to Detect Topographic Change in Long Valley Caldera, California

Hofton, M. A., Scripps Institution of Oceanography, USA; Minster, J.–B., Scripps Institution of Oceanography, USA; Ridgway, J. R., Scripps Institution of Oceanography, USA; Blair, J. B., NASA Goddard Space Flight Center, USA; Earth Surface Remote Sensing; 1997; ISSN 0277-786X; Volume 3222, pp. 295-306; In English; Earth Surface Remote Sensing, 22-25 Sep. 1997, London, UK; Sponsored by International Society for Optical Engineering, USA

Contract(s)/Grant(s): NAS5-33019; NAG5-3001; Copyright; Avail: Issuing Activity

Long Valley caldera California, is a site of extensive volcanism, persistent seismicity, and uplift of a resurgent dome, currently at a rate of about 3 cm/year. Airborne laser altimetry was used to determine the surface topography of the region in 1993. A repeat mission occurred in 1995. Three different laser altimeters were flown, dubbed ATLAS, SLICER and RASCAL. Data processing consists of the combination of the aircraft trajectory and attitude data with the laser range, the determination of an atmospheric delay, laser pulse timing errors, laser system biases, and data geolocation to obtain the position of the laser spot on the ground. Results showed that using the ATLAS and SLICER instruments, the elevation of an overflown lake is determined to precisions of 3.3 cm and 2.9 cm from altitudes of 500 m and 3 km above the ground, and about 10 cm using the RASCAL instrument from 500 m above ground. Comparison with tide gauge data showed the laser measurements are able to resolve centimeter-level changes in the lake elevation over time. Repeat pass analysis of tracks over flat surfaces indicate no systematic biases affect the measurement procedure of the ATLAS and SLICER instruments. Comparison of GPS and laser-derived elevations of easily-identifiable features in the caldera confirm the horizontal accuracy of the measurement is within the diameter of the laser footprint, and vertical accuracy is within the error inherent in the measurement. Crossover analysis shows that the standard error of the means at track intersection points within the caldera, and dome (i.e., where zero and close to the maximum amount of uplift is expected) are about I cm, indicating elevation change at the 3 cm/year level should be detectable. We demonstrate one of the powerful advantages of scanning laser altimetry over other remote sensing techniques; the straightforward creation of precise digital elevation maps of overflown terrain. Initial comparison of the 1993-1995 data indicates uplift occurred, but filtering is required to remove vegetation effects. Although research continues to utilize the full potential of laser altimetry data, the results constitute a successful demonstration that the technique may be used to perform geodetic monitoring of surface topographic change. Author

Airborne Lasers; Altimetry; Data Processing; Remote Sensing; Topography; Laser Altimeters

20000073234 NASA Goddard Space Flight Center, Greenbelt, MD USA

Estimating Long Term Surface Soil Moisture in the GCIP Area From Satellite Microwave Observations

Owe, Manfred, NASA Goddard Space Flight Center, USA; deJeu, Vrije, Vrije Univ., Netherlands; VandeGriend, Adriaan A., Vrije

Univ., Netherlands; [2000]; 1p; In English; Hydrology, 3-7 Apr. 2000, Santa Fe, NM, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Soil moisture is an important component of the water and energy balances of the Earth's surface. Furthermore, it has been identified as a parameter of significant potential for improving the accuracy of large-scale land surface-atmosphere interaction models. However, accurate estimates of surface soil moisture are often difficult to make, especially at large spatial scales. Soil moisture is a highly variable land surface parameter, and while point measurements are usually accurate, they are representative only of the immediate site which was sampled. Simple averaging of point values to obtain spatial means often leads to substantial errors. Since remotely sensed observations are already a spatially averaged or areally integrated value, they are ideally suited for measuring land surface parameters, and as such, are a logical input to regional or larger scale land process models. A nine-year database of surface soil moisture is being developed for the Central USA from satellite microwave observations. This region forms much of the GCIP study area, and contains most of the Mississippi, Rio Grande, and Red River drainages. Daytime and nighttime microwave brightness temperatures were observed at a frequency of 6.6 GHz, by the Scanning Multichannel Microwave Radiometer (SMMR), onboard the Nimbus 7 satellite. The life of the SMMR instrument spanned from Nov. 1978 to Aug. 1987. At 6.6 GHz, the instrument provided a spatial resolution of approximately 150 km, and an orbital frequency over any pixel-sized area of about 2 daytime and 2 nighttime passes per week. Ground measurements of surface soil moisture from various locations throughout the study area are used to calibrate the microwave observations. Because ground measurements are usually only single point values, and since the time of satellite coverage does not always coincide with the ground measurements, the soil moisture data were used to calibrate a regional water balance for the top 1, 5, and 10 cm surface layers in order to interpolate daily surface moisture values. Such a climate-based approach is often more appropriate for estimating large-area spatially averaged soil moisture because meteorological data are generally more spatially representative than isolated point measurements of soil moisture. Vegetation radiative transfer characteristics, such as the canopy transmissivity, were estimated from vegetation indices such as the Normalized Difference Vegetation Index (NDVI) and the 37 GHz Microwave Polarization Difference Index (MPDI). Passive microwave remote sensing presents the greatest potential for providing regular spatially representative estimates of surface soil moisture at global scales. Real time estimates should improve weather and climate modelling efforts, while the development of historical data sets will provide necessary information for simulation and validation of long-term climate and global change studies.
Author
Soil Moisture; Estimating; Satellite Observation; Atmospheric Models; Climate Change; Surface Reactions

20000073291 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
SeaWinds on QuikSCAT Mission and Early Science Results
Tsai, Wu–Yang, Jet Propulsion Lab., California Inst. of Tech., USA; Graf, James E., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

SeaWinds on QuikSCAT (QSCAT) is a dedicated satellite remote sensing mission for measuring ocean surface wind speed and direction, using a spinning, pencil-beam Ku-band scatterometer. It is a replacement mission for NASA Scatterometer (NSCAT), which was launched on board of the Japan's Advanced Earth Observation System (ADEOS-1) in August 1996 and returned 10 months of high quality data before the mission was terminated in June, 1997 due to the failure of the ADEOS-1 spacecraft. Since the next NASA scatterometer mission, SeaWinds on ADEOS-2 (SeaWinds), will not be launched until November 2000, NASA decided to fill the data gap by launching the QSCAT mission. Furthermore, after year 2000. the potential exists for using both the QSCAT and SeaWinds to provide approximately 6 hours global coverage of the marine winds. QSCAT is currently scheduled for launch in April, 1999 from Vandenberg Air Force Base, using Titan-II launch vehicle. The purpose of this paper is to first present the mission objectives, the spacecraft and instrument design, ground receiving systems, the science data processing system, and the data products. We will then present the post-launch calibration and verification results of the QSCAT end-to-end sensor system. Finally, we present some of the key results obtained from the first two months of the mission, which include ocean surface wind measurements, ice detection and classification, global snow cover detection, and flood detection.
Author
Earth Observations (From Space); Marine Meteorology; Remote Sensing; Wind (Meteorology); Wind Measurement; Wind Velocity

20000073296 NASA Goddard Space Flight Center, Greenbelt, MD USA
L-Band Radiometer Measurements of Conifer Forests
Lang, R., NASA Goddard Space Flight Center, USA; LeVine, D., NASA Goddard Space Flight Center, USA; Chauhan, N., NASA Goddard Space Flight Center, USA; deMatthaeis, P., NASA Goddard Space Flight Center, USA; Bidwell, S., NASA Goddard Space Flight Center, USA; Haken, M., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; Geoscience and Remote

Airborne radiometer measurements have been made at L-band over conifer forests in Virginia to study radiometric response to biomass and soil moisture. The horizontally polarized synthetic aperture radiometer, ESTAR, has been deployed abroad a NASA-P3 aircraft which is based at the Goddard Space Flight Center's Wallops Flight Facility. The instrument has been mounted in the bomb bay of the P-3 and images data in the cross track direction. Aircraft and surface measurements were made in July, August and November of 1999 over relatively homogeneous conifer stands of varying biomass. The surface measurements included soil moisture measurements in several stands. The soil moisture was low during the July flight and highest in November after heavy rains had occurred. The microwave images clearly distinguished between the different forest stands. Stand age, obtained from International Paper Corporation which owns the stands, showed a strong correlation between brightness temperature and stand age. This agrees with previous simulation studies of conifer forests which show that the brightness temperature increases with increasing stand biomass. Research is continuing to seek a quantitative correlation between the observed brightness temperature of the stands and their biomass and surface soil moisture.
Author
Biomass; Soil Moisture; Synthetic Apertures; Ultrahigh Frequencies; Conifers; Forests

20000073297 NASA Goddard Space Flight Center, Greenbelt, MD USA

Passive Microwave Measurements Over Conifer Forests at L-Band and C-Band

LeVine, D. M., NASA Goddard Space Flight Center, USA; Lang, R., NASA Goddard Space Flight Center, USA; Chauhan, N., NASA Goddard Space Flight Center, USA; Kim, E., NASA Goddard Space Flight Center, USA; Bidwell, S., NASA Goddard Space Flight Center, USA; Goodberlet, M., NASA Goddard Space Flight Center, USA; Haken, M., NASA Goddard Space Flight Center, USA; deMatthaeis, P., NASA Goddard Space Flight Center, USA;

Measurements have been made at L-band and C-band over conifer forests in Virginia to study the response of passive microwave instruments to biomass and soil moisture. A series of aircraft measurements were made in July, August and November, 1999 over relatively homogenous conifer forests of varying biomass. Three radiometers participated in these measurements. These were: 1) the L-band radiometer ESTAR, a horizontally polarized synthetic aperture radiometer which has been used extensively in past measurements of soil moisture; 2) the L-band radiometer SLFMR, a vertically polarized cross-track scanner which has been used successfully in the past for mapping sea surface salinity; and 3) The ACMR, a new C-band radiometer which operates at V- and H-polarization and in the configuration for these experiments did not scan. All three radiometers were flown on the NASA P-3 aircraft based at the Goddard Space Flight Center's Wallops Flight Facility. The ESTAR and SLFMR were mounted in the bomb bay of the P-3 and imaged across track whereas the ACMR was mounted to look aft at 54 degrees up from nadir. Data was collected at altitudes of 915 meters and 457 meters. The forests consisted of relatively homogeneous "managed" stands of conifer located near Waverly, Virginia. This is a relatively flat area about 30 miles southeast of Richmond, VA with numerous stands of trees being grown for the forestry industry. The stands selected for study consisted of areas of regrowth and mature stands of pine. In addition, a small stand of very large trees was observed. Soil moisture sampling was done in each stand during the aircraft over flights. Data was collected on July 7, August 27, November 15 and November 30, 1999. Measurements were made with ESTAR on all days. The ACMR flew on the summer missions and the SLFMR was present only on the August 27 flight. Soil moisture varied from quite dry on July 7 to quite moist on November 30 (which was shortly after a period of rain). The microwave images clearly distinguish between the different forest stands. Research is continuing to seek a quantitative correlation with biomass and surface soil moisture.
Author
Soil Moisture; Microwave Imagery; Conifers; C Band; Ultrahigh Frequencies; Synthetic Apertures; Forest Management; Microwave Radiometers; Biomass

20000073298 NASA Goddard Space Flight Center, Greenbelt, MD USA

Development of a Two Dimensional Synthetic Aperture Radiometer at L-Band

LeVine, D. M., NASA Goddard Space Flight Center, USA; Carver, K., Massachusetts Univ., USA; Goodberlet, M., Quadrant Engineering, Inc., USA; Popstefanija, I., Quadrant Engineering, Inc., USA; Mead, J., Quadrant Engineering, Inc., USA;

A radiometer that uses aperture synthesis in two dimensions is being built as part of research under NASA's Instrument Incubator Program. The instrument development team consists of engineers at the Goddard Space Flight Center, the University of Massachusetts and Quadrant Engineering. This will be an aircraft instrument operating at L-band which builds on the heritage of ESTAR. The choice of L-band was made because the problem of achieving adequate resolution in space is most critical at this

wavelength and because a polarimetric, conical scanning airborne radiometer for future experiments to validate soil moisture and ocean salinity retrieval algorithms is not currently available. The instrument will be designed to fly on the NASA P-3 aircraft in a nadir pointing mode, although other options are possible. The antenna will consist of an array of modules arranged in a rectangular grid. Each module will be comprised of a printed circuit dual-polarized patch and integrated receiver. The distribution of modules within the rectangular array will be adjustable so that several different imaging configurations (e.g. "+","Y", "T") can be employed. The integrated receiver will provide amplification and conversion to IF. The IF signal will be routed to a processor where the required correlations performed. The I and Q channels will be created digitally and the correlations will be done digitally in this processor. The digitization will be done with sufficient bits to study the effects of quantization on radiometer performance. A computer/controller will store the data for conversion to an image and will also perform temperature control and other data interfacing and housekeeping tasks. The instrument is currently in the bread boarding phase of development. A design of the critical components has been completed and hardware is being assembled to test the individual elements. It is expected that a complete 2-channel correlator will be tested by the summer of 2000 and that the complete instrument will be ready for flight tests the following summer (2001).

Author

Synthetic Apertures; Radiometers; Aircraft Instruments; Imaging Techniques; Ultrahigh Frequencies; Flight Tests

20000073806 Forschungszentrum Geesthacht G.m.b.H., Germany

Study on Earth Radiation Budget mission scenarios

Dlhopolsky, R.; Hollmann, R.; Mueller, J.; Stuhlmann, R.; Dec. 31, 1997; 129p; In English

Report No.(s): DE99-715929; GKSS-97/E/71; No Copyright; Avail: Department of Energy Information Bridge

The goal of this study is to study optimized satellite configurations for observation of the radiation balance of the earth. We present a literature survey of earth radiation budget missions and instruments. We develop a parametric tool to simulate realistic multiple satellite mission scenarios. We use Meteosat data sampled at three hour intervals as a database to simulate atmospheric scenes. Input variables are satellite equatorial crossing time and instrument characteristics. Regional, zonal and global monthly averages of shortwave and longwave fluxes for an ideal observing system and several realistic satellite scenarios are produced. Comparisons show that the three satellite combinations which have equatorial crossing times at midmorning, noon and midafternoon provide the best shortwave monitoring.

NTIS

Earth Radiation Budget; Atmospheric Radiation; Solar Radiation

20000074080 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Using Spaceborne Ku-Band Scatterometer for Global Snow Cover Monitoring

Nghiem, S. V., Jet Propulsion Lab., California Inst. of Tech., USA; Tsai, W.–Y., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; Geoscience and Remote Sensing, 1999, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

We demonstrate for the first time the utility of spaceborne Ku-band scatterometer for global snow cover monitoring. Satellite radar data were collected over the globe by the NASA Scatterometer (NSCAT) operated at 14 GHz on board the Japanese ADEOS spacecraft from September 1996 to June 1997, spanning the 1997 seasonal snow season. First, we present backscatter signature of dry and wet snow to facilitate the interpretation of NSCAT backscatter evolution over snow cover regions. Surface field experiments indicated that dry snow backscatter at Ku band is approximately 40 times stronger than that at C band. Thus, Ku-band scatterometer measurements are sensitive to snow cover, which is typically transparent to C-band scatterometer returns. Furthermore, Ku-band backscatter does not saturate for most of natural snow depths as compared to radar responses at 19 GHz and 37 GHz or higher frequencies which have more limited penetration depths into snow. Ku-band backscatter is also sensitive to wetness in snow, which is appropriate to detect early snow melt conditions. Using the snow backscatter characteristics, we investigate NSCAT backscatter evolution over global snow cover regions throughout the 1997 snow season. The results reveal detail delineations between different regional snow areas. We show the correlation of these delineations with the boundaries of different global snow classes defined by the U.S. Army Cold Regions Research and Engineering Laboratory snow classification system. Using in-situ snow depth data from the U.S. National Climatic Data Center, we show that Ku-band backscatter corresponds very well to the trend of snow melt while snow mapping products (U.S. Climate Prediction Center gridded snow charts) from visible sensors does not reflect the fast snow melt trend. to illustrate the practical application of global snow monitoring with spaceborne Ku-band scatterometer, we present NSCAT backscatter response corresponding to the snow event leading to the 1997 Flood of the Century over the U.S. Northern plains and the Canadian prarie region, which caused loss of lives and several billion dollars in flood related damages and cleanup costs. Finally, we show that the fixed incidence configuration of Seawinds scatterometers, to be launched

on QuickSCAT and on ADEOS-2 in the near future, is better for snow monitoring and then discuss the use of future high-resolution scatterometers for global snow mapping.

Author

Snow Cover; Monitors; Scatterometers; Data Acquisition; Drying; Laboratory Equipment; Moisture Content; Radar Data; Satellite-Borne Instruments

20000074081 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Polarization Reversal Over Flooded Regions and Applications to Large-Scale Flood Mapping with Spaceborne Scatterometers

Nghiem, Son V., Jet Propulsion Lab., California Inst. of Tech., USA; Liu, W. Timothy, Jet Propulsion Lab., California Inst. of Tech., USA; Xie, Xiao–Su, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; Geoscience and Remote Sensing, 1999, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

We present the polarization reversal in backscatter over flooded land regions, and demonstrate for the first time the utility of spaceborne Ku-band scatterometer for large-scale flood mapping. Scatterometer data were collected over the globe by the NASA Scatterometer (NSCAT) operated at 14 GHz on the Japanese ADEOS spacecraft from September 1996 to June 1997. During this time span, several severe floods occurred. Over most land surface, vertical polarization backscatter (Sigma(sub upsilon(upsilon)) is larger than horizontal polarization backscatter (sigma(sub hh)). Such polarization characteristics is reversed and sigma(sub upsilon(upsilon)) is smaller than sigma(sub hh) over flooded regions, except under a dense forest canopy. The total backscatter from the flooded landscape consists of direct backscatter and boundary-interaction backscatter. The direct term is contributed by direct backscattering from objects protruding above the water surface, and by backscattering from waves on the water surface. The boundary-interaction term is contributed by the forward scattering from the protruding objects and then reflected from the water surface, and also by the forward scattering from these objects after the water-surface reflection. Over flooded regions, the boundary-interaction term is dominant at large incidence angles and the strong water-surface reflection is much larger for horizontal polarization than the vertical one due to the Brewster effect in transverse-magnetic waves. These scattering mechanisms cause the polarization reversal over flooded regions. An example obtained with the Analytic Wave Theory is used to illustrate the scattering mechanisms leading to the polarization reversal. We then demonstrate the utility of spaceborne Ku-band scatterometer for large-scale flood mapping. We process NSCAT data to obtain the polarization ratio sigma(sub hh)/sigma(sub upsilon(upsilon)) with colocated data at incidence angles larger than 40 deg. The results over Asian summer monsoon regions in September-October 1996 indicate flooded areas in many countries such as Bangladesh, India, Lao, Vietnam, Cambodia, and China. Reports documented by the United Nation Department of Humanitarian Affairs (now called UN Office for the Coordination of Humanitarian Affairs) show loss of many lives and severe flood related damages which affected many million people in the corresponding flooded areas. We also map the NSCAT polarization ratio over the same regions in the "dry season" in January 1997 as a reference to confirm our results. Furthermore, we obtain concurrent ocean wind fields also derived from NSCAT data, and Asia topographic data (USGS GTOPO30) to investigate the flooded area. The results show that winds during summer monsoon season blowing inland, which perplex flood problems. Overlaying the topographic map over NSCAT results reveals an excellent correspondence between the confinement of flooded area within the relevant topographic features, which very well illustrates the value of topographic wetness index. Finally, we discuss the applications of future spaceborne scatterometers, including QuikSCAT and Seawinds, for flood mapping over the globe.

Author

Backscattering; Data Processing; Earth Surface; Flood Plains; Geological Surveys; Mapping; Moisture Content; Polarization Characteristics; Scatterometers; Velocity Distribution

20000074114 NASA Marshall Space Flight Center, Huntsville, AL USA

Thermal Remote Sensing and the Thermodynamics of Ecosystem Development

Luvall, Jeffrey C., NASA Marshall Space Flight Center, USA; Kay, James J., NASA Marshall Space Flight Center, USA; Fraser, Roydon F., Waterloo Univ., Canada; [2000]; 1p; In English; International Workshop on Advances in Energy Studies, 20-29 May 2000, Porto Venere, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

Thermal remote sensing can provide environmental measuring tools with capabilities for measuring ecosystem development and integrity. Recent advances in applying principles of nonequilibrium thermodynamics to ecology provide fundamental insights into energy partitioning in ecosystems. Ecosystems are nonequilibrium systems, open to material and energy flows, which grow and develop structures and processes to increase energy degradation. More developed terrestrial ecosystems will be more effective

at dissipating the solar gradient (degrading its energy content). This can be measured by the effective surface temperature of the ecosystem on a landscape scale.

Author

Remote Sensing; Ecosystems; Topography; Nonequilibrium Thermodynamics

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ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.

20000068975 McMullen (John J.) Associates, Inc., Alexandria, VA USA

Marine Molten Carbonate Fuel Cell Demonstration Module. USCGC Vindicator Ship Interface Studies *Final Report*

Karni, Zvi; Fontneau, Peter; May 1999; 65p; In English

Contract(s)/Grant(s): DTCG39-95-D-E99010

Report No.(s): AD-A368291; USCG-D-12-99; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

In this study, the US Coast Guard (USCG) investigated the impact upon CGC VINDICATOR ship systems resulting from potential conversion to fuel cell propulsion and auxiliary power. VINDICATOR is a T-AGOS class monohull, 224-feet in length, powered by four Caterpillar diesel-electric generators with DC propulsion motors. USCG selected this vessel as a candidate for development and potential demonstration of fuel cell power on board ships. Space and weight limitations and marine operational requirements uncovered during this study are believed to be applicable to other ship installations. Detailed changes to structural, electrical, fuel delivery, exhaust management and related systems necessitated by removal of the four main diesel generators and replacement by four molten carbonate fuel cell modules were developed. Also developed was the outline design of each 625 kW molten carbonate fuel cell Demonstration Module, including fuel processing, fuel cell stacks, and inverter. A dynamic computer simulation model was created which linked the fuel cell performance to ship parameters including displacement, speed, and loading cycles. This information was used to analyze the ship integration impacts based on the fuel cell design. Included with this final summary report are outline figures of detailed removal and installation drawings detailing existing and proposed arrangements. Several conclusions are made. The proposed fuel cell modules are compatible with existing ship interfaces, with relatively minor modifications. The fuel cell modules are substantially larger than the diesel generators they replace, necessitating removal of the non-structural side shell within the main diesel generator room. Existing air handling, exhaust, and fuel delivery systems can be reused, ship performance (stability and seakeeping) is unchanged, and minor maneuvering performance changes may result. Increased range is expected due to the predicted higher efficiency of the fuel cells.

DTIC

Molten Carbonate Fuel Cells; Dynamic Models

20000069030 Army Research Lab., Sensors Directorate, Adelphi, MD USA

Loss of Rate Capability in LiMn2O4 / Carbon Cells, *Sep. 1998-Sep. 1999*

Read, Jeffrey; Wolfenstine, Jeff; Foster, Donald; Behl, Wishvender; Mar. 2000; 26p; In English

Report No.(s): AD-A376846; ARL-TR-2115; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present a survey of the available literature on the loss in rate capability of LiMn2O4-based lithium-ion batteries. Manganese dissolution is identified as the main cause of rate capability loss, as well as loss in during storage. Manganese dissolution capacity results in passivation of both the cathode and anode, structural changes at the spinel surface, and loss in particle contact. Manganese dissolution can be reduced by surface treatments, increased electrolyte stability, and removal of acidic protons from the electrolyte.

DTIC

Metal Ions; Electric Batteries; Surface Properties; Surface Finishing

20000069374 International Fuel Cells Corp., South Windsor, CT USA

Energy Production and Pollution Prevention at Sewage Treatment Plants Using Fuel Cell Power Plants

Spiegel, R. J.; Preston, J. L.; 1999; 8p; In English; 3rd; Fuel Cell, 30 Nov. - 3 Dec. 1999, Nagoya, Japan

Report No.(s): PB2000-102943; EPA/600/A-99/097; No Copyright; Avail: National Technical Information Service (NTIS)

The paper discusses energy production and pollution prevention at sewage treatment plants using fuel cell power plants. Anaerobic digester gas (ADG) is produced at waste water treatment plants during the anaerobic treatment of sewage to reduce

solids. Fuel cells are an emerging technology to produce electricity and clean heat. The electricity produced can either be used by the waste water plant or sold to the electrical grid, while the heat is used by the waste water plant or sold to the electrical grid, while the heat is used to aid the anaerobic process. EPA, in conjunction with ONSI, recently utilized a 200-kW phosphoric acid fuel cell power plant to operate on ADG at a sewage treatment plant in Yonkers, NY.

NTIS

Pollution Control; Sewage Treatment; Water Treatment

20000070331 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

A Survey and Projected Performance of Pulsed Power Supplies at Aberdeen Proving Ground, MD *Final Report, Jun.-Sep. 1999*

Zielinski, Alexander E.; May 2000; 25p; In English

Report No.(s): AD-A377867; ARL-TN-163; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

   Electric guns require energy produced by a pulsed electrical discharge to accelerate the launch package. A number of research projects that utilize pulsed high-power sources are on-going at the U.S. Army Research Laboratory, Aberdeen Proving Ground (APG), MD. Demonstrations of electric gun technology thus far utilized rotating machinery or capacitor based pulsed power supplies (PPS's). A survey of PPS's at APG was conducted. While a majority of the PPS's is not directly compatible with a railgun load they can be modified an combined into a multiple, trailer-based PPS. In order to obtain 20 MJ of muzzle kinetic energy a railgun launcher with greater than 50% system efficiency will require a 40 MI PPS. However, a substantial investment in technology, as opposed to hardware, results in better utilization of a lower energy, site-based PPS. More modest muzzle energy requirements (8-11 MJ) can be satisfied with either a site- or trailer-based 32 MI PPS and a launcher efficiency of 56%. Additionally, the site- or trailer-based PPS can easily supply a few megajoules to an electrothermal-chemical (ETC) capillary also.

DTIC

Power Supplies; Energy Requirements; Railgun Accelerators; Supplying; System Effectiveness

20000070470 NASA Goddard Space Flight Center, Greenbelt, MD USA

Thermal Considerations of Space Solar Power Concepts with 3.5 GW RF Output

Choi, Michael K., NASA Goddard Space Flight Center, USA; [2000]; 11p; In English; 35th; Intersociety Energy Conversion Engineering, 24-27 Jul. 2000, Las Vegas, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2000-2904; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

   This paper presents the thermal challenge of the Space Solar Power (SSP) design concepts with a 3.5 GW radio-frequency (RF) output. High efficiency klystrons are thermally more favored than solid state (butterstick) to convert direct current (DC) electricity to radio-frequency (RF) energy at the transmitters in these concepts. Using klystrons, the heat dissipation is 0.72 GW. Using solid state, the heat dissipation is 2.33 GW. The heat dissipation of the klystrons is 85% at 500C, 10% at 300C, and 5% at 125C. All the heat dissipation of the solid state is at 100C. Using klystrons, the radiator area is 74,500 square m Using solid state, the radiator area is 2,362,200 square m Space constructable heat pipe radiators are assumed in the thermal analysis. Also, to make the SSP concepts feasible, the mass of the heat transport system must be minimized. The heat transport distance from the transmitters to the radiators must be minimized. It can be accomplished by dividing the radiator into a cluster of small radiators, so that the heat transport distances between the klystrons and radiators can be minimized. The area of each small radiator is on the order of 1 square m. Two concepts for accommodating a cluster of small radiators are presented. If the distance between the transmitters and radiators is 1.5 m or less, constant conductance heat pipes (CCHPs) are acceptable for heat transport. If the distance exceeds 1.5 m, loop heat pipes (LHPs) are needed.

Author

Heat Pipes; Spacecraft Radiators; Cooling; Solar Power Satellites; Klystrons; Cooling Systems

20000070509 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Fiscal 1997 report on the results of the New Sunshine Project subsidiary operation. Development of the geothermal water use power plant, etc. (development of the binary cycle power plant / development of the geothermal well MWD system)

Mar. 31, 1998; 239p; In Japanese; In English

Report No.(s): DE99-718350; ETDE/JP-99718350; No Copyright; Avail: Department of Energy Information Bridge

   For the purpose of improving efficiency and accuracy in geothermal well drilling, the development was conducted of an MWD (measuring while drilling) which detects borehole information in real time. In fiscal 1997, the following R and D were carried out. As to the downhole equipment, the actual well experiment on the sonde was conducted to confirm the basic performance. The design improvement, trial fabrication and experiment were conducted on mud pulse generating valve driving control

equipment, bore hole signal processing unit and temperature correction circuit portion in the sonde. Concerning electronic parts, a heat resistance confirming test was conducted for data collection/assessment. Further, jigs were fabricated for tests to confirm working of each equipment. Relating to the ground equipment, conducted were improvement of the decoded program and betterment of the analytical system and interface. As to the development of the analytical system, data on depth were added to the azimuth/inclination obtained from MWD, which enabled indication of a well drilling tracing chart while drilling.
NTIS
Water; Geothermal Technology; Drilling

20000070510 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report on the results of the verification survey of a new load leveling method
Mar. 31, 1998; 279p; In Japanese; In English
Report No.(s): DE99-718353; ETDE/JP-99718353; No Copyright; Avail: Department of Energy Information Bridge
 A study was conducted of a practical applicability of the electric double layer capacitor as a new electric power storage technique. In the study, a comparison was made between the capacitor system and the NAS battery which is most commercialized as one for power storage of all the secondary batteries. The capacitor system is excellent in cycle life, system efficiency, and safety/environment, but in energy density it is approximately a tenth of that of the NAS battery so far. The capacitor system, however, is high in filling rate in modules and enables compact design. As to the 35 fabricated electric double layer capacitor cells, the following tests were carried out: charge and discharge, internal resistance measurement, energy density measurement, characteristics of charge/discharge efficiency, self-discharge characteristics, and characteristics of circumferential temperature. As a result of the tests, the cell with volume energy density of 16.4-16.8 Wh/L was fixed to the module with a filling rate of about 93% and achieved an energy density of 15 Wh/L.
NTIS
Leveling; Loads (Forces); Capacitors

20000070511 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Report of FY 1997 on the international cooperation project. Survey of globalization of the effective energy resource utilization technology (development of high-accuracy acceleration measurement system)
Mar. 31, 1998; 142p; In Japanese; In English
Report No.(s): DE99-718354; ETDE/JP-99718354; No Copyright; Avail: Department of Energy Information Bridge
 This report describes effectiveness of a system for measuring the acceleration and force in high accuracy by combining a laser interference meter and a vibration stand. A possibility of pressure sensitive paper to the impact force measurement in the collision examination is also described. The results obtained in FY 1997 are as follows. For the investigation of calibration system of acceleration and force sensor, one-dimensional interferometer system has been developed, which is standardized in ISO5347 accelerometer calibration. Thus, an interference fringe processing software has been made. Moreover, construction of a three-dimensional interferometer system has been started. For the characterization evaluation of pressure sensitive papers, it was succeeded in obtaining an elasticity wave pulse maximum about 1 msec by adopting the flight body made of resin. As a result, evaluation of the force sensor in the frequency area has become possible. to calculate the displacement of a body structural material in the collision experiment, an acceleration sensor has been made for trial purposes. For the international research cooperation, the working plan of a joint research with US Texas Christian University has been concluded.
NTIS
Acceleration Measurement; Energy Conservation

20000070514 New Energy and Industrial Technology Development Organization, Tokyo, Japan
Fiscal 1997 report on the results of the New Sunshine Project subsidiary operation. Development of a geothermal water use power plant, etc. / technical development of the hot dry rock power generation system (development of electric technology)
Mar. 31, 1998; 166p; In Japanese; In English
Report No.(s): DE99-718358; ETDE/JP-99718358; No Copyright; Avail: Department of Energy Information Bridge
 For the purpose of using hot dry rock energy to power generation, the R and D was continued of element technology of the hot dry rock power generation. In fiscal 1997, the construction of ground facilities, etc. for long-term circulation experiment was proceeded with to make data analysis for study of the experimental results. As for preparation for the long-term circulation experiment, design/fabrication/construction of experimental facilities were commenced, and review/fabrication of the monitoring system were conducted to strengthen the monitoring network of microearthquakes. In relation to the analytical research, using models connecting reservoirs and wells, relationships were studied among the distance between injection well and production

well, production flow rate, and long-term thermal extraction characteristics of reservoirs. Further, to study structures of shallow/ deep reservoirs at the Hijiori hot dry rock experimental field, re-determined were mechanism solutions of AE in deep hydraulic fracturing experiments, three well circulation tests, and preliminary circulation tests, and at the same time stress fields were studied. Fracture models were made and the simulation program was revised.
NTIS

Water; Systems Engineering; Geothermal Energy Utilization; Rocks; Electric Power Plants

20000070671 Risoe National Lab., Wind Energy and Atmospehric Physics Dept., Roskilde, Denmark
Field rotor measurements. Data sets prepared for analysis of stall hysteresis
Aagaard Madsen, H.; Thirstrup Petersen, J.; Bruining, A.; Brand, A.; Graham, M.; May 31, 1998; 103p; In English
Report No.(s): DE99-701961; RISO-R-1046(EN); ISBN 87-550-2385-1; No Copyright; Avail: Department of Energy Information Bridge

As part of the JOULE-3 project 'STALLVIB' an analysis and synthesis of the data from the field rotor experiments at ECN, Delft University, Imperial College, NREL and Risoe has been carried out. This has been done in order to see to what extent the data could be used for further development and validation of engineering dynamic stall models. A detailed investigation of the influence of the post-processing of the different data sets has been performed. Further, important statistical functions such as PSD spectra, coherence and transfer functions have been derived for the data sets which can be used as basis for evaluation of the quality of the data seen relative to actual application of the data. The importance of using an appropriate low-pass filtering to remove high frequency noise has been demonstrated when the relation between instantaneous values of e.g. alpha and C(sub N) is considered. In general, the complicated measurement on a rotor of alpha and w and the interpretation of these parameters combined with the strongly three- dimensional, turbulent flow field around the rotating blade has the consequence that it seems difficult to derive systematic information from the different data sets about stall hysteresis. In particular, the measurement of (alpha), which determination of the stagnation point gives reasonable data below stall but fails in stall. On the other hand, measurements of alpha with a five hole pitot tube can be used also in the stall region. Another main problem is the non-dimensionalization of the coefficients C(sub N) and C(sub r). If the dynamic pressure used for the non-dimensionalization is not fully correlated with the aerodynamic pressure over the considered airfoil section due to e.g. influence of the gravity on the pressure pipes, the hysteresis loops will be distorted. However, using the data with caution and applying a suitable post- processing as described by the different participants, it will probably be possible to obtain some information on stall hysteresis from the field rotor data. An example of use of the data for derivation of the empirical constants in the fgh dynamic stall model is shown at the end of the report.
NTIS

Rotors; Aerodynamic Stalling; Hysteresis; Dynamic Pressure; Three Dimensional Flow

20000070675 Hahn-Meitner-Inst. G.m.b.H., Berlin, Germany
Photoluminescence of polycrystalline CuInS2 absorber layers and solar cells
Toepper, K.; Dec. 31, 1996; 97p; In German; In English
Report No.(s): DE98-770847; HMI-B-545; No Copyright; Avail: Department of Energy Information Bridge

CuInS2 is a promising material for the development of high efficiency thin film solar cells. The photoluminescence of CuInS2 thin films and solar cells is examined in this work. From the recombination of excitons no variation of the band gap with temperature is observed for T less than or equal 150 K. Samples prepared with excess of indium show strong phonon coupling of a conduction band - acceptor transition (copper vacancy). For samples prepared with excess of copper, a donor acceptor pair recombination is observed (sulphur vacancy as donor and indium vacancy or copper-indium antisite as acceptor). Other samples show a donor acceptor pair recombination at 1.445 eV (sulphur vacancy - copper vacancy). The intensity of this peak increases by more than a factor of 100 due to annealing in hydrogen. Annealing in oxygen reduces the peak again. This phenomenon is reversible and is also observed in the photoluminescence of solar cells. The measurement of hydrogen depth profiles shows that no hydrogen is incorporated by hydrogen annealing. A simple defect model is developed that assumes the occupation of sulphur vacancies by oxygen at grain boundaries. Annealing in hydrogen atmosphere removes oxygen from the vacancies, which are potential states for recombination. Subsequent annealing in oxygen reoccupies the sulphur sites in part thus reducing the intensity of the corresponding peak.
NTIS

Photoluminescence; Polycrystals; Solar Cells; Copper Sulfides; Indium Sulfides; Thin Films; Absorbers (Materials)

20000070847 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Role of Electrolyte Upon the SEI Formation Characteristics and Low Temperature Performance of Lithium-Ion Cells With Graphite Anodes

Smart, M. C., Jet Propulsion Lab., California Inst. of Tech., USA; Ratnakumar, B. V., Jet Propulsion Lab., California Inst. of Tech., USA; Greenbaum, S., Jet Propulsion Lab., California Inst. of Tech., USA; Surampudi, S., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 3p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Quarternary lithium-ion battery electrolyte solutions containing ester co-solvents in mixtures of carbonates have been demonstrated to have high conductivity at low temperatures (is less than -20C). However, in some cases the presence of such co-solvents does not directly translate into improved low temperature cell performance, presumably due to the formation of ionically resistive surface films on carbonaceous anodes. In order to understand this behavior, a number of lithium-graphite cells have been studied containing electrolytes with various ester co-solvents, including methyl acetate (MA), ethyl acetate (EA), ethyl propionate (EP), and ethyl butyrate (EB). The charge/discharge characterization of these cells indicates that the higher molecular weight esters result in electrolytes which possess superior low temperature performance in contrast to the lower molecular weight ester-containing solutions, even though these solutions display lower conductivity values.
Author

Esters; Lithium Batteries; Electrolytes; Charge Efficiency; Electric Discharges; Low Temperature

20000073303 Composite Optics, Inc., San Diego, CA USA

Development of Electrostatically Clean Solar Array Panels *Final Report, 30 Jul. 1999 - 16 May 2000*

Stern, Theodore G., Composite Optics, Inc., USA; May 16, 2000; 141p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS5-99236
Report No.(s): COI-TR-1413-002; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Certain missions require Electrostatically Clean Solar Array (ECSA) panels to establish a favorable environment for the operation of sensitive scientific instruments. The objective of this program was to demonstrate the feasibility of an ECSA panel that minimizes panel surface potential below 100mV in LEO and GEO charged particle environments, prevents exposure of solar cell voltage and panel insulating surfaces to the ambient environment, and provides an equipotential, grounded structure surrounding the entire panel. An ECSA panel design was developed that uses a Front Side Aperture-Shield (FSA) that covers all inter-cell areas with a single graphite composite laminate, composite edge clips for connecting the FSA to the panel substrate, and built-in tabs that interconnect the FSA to conductive coated coverglasses using a conductive adhesive. Analysis indicated the ability of the design to meet the ECSA requirements. Qualification coupons and a 0.5m x 0.5m prototype panel were fabricated and tested for photovoltaic performance and electrical grounding before and after exposure to acoustic and thermal cycling environments. The results show the feasibility of achieving electrostatic cleanliness with a small penalty in mass, photovoltaic performance and cost, with a design is structurally robust and compatible with a wide range of current solar panel technologies.
Author

Solar Arrays; Thermal Cycling Tests; Solar Cells; Energy Conversion Efficiency; Earth Orbital Environments

20000073700 Federal Energy Technology Center, Morgantown, WV USA

Partial Oxidation Technique for Fuel-Cell Anode Exhaust-Gas Synthesis

Edward H. Robey,; Randall S. Gemmen,; Nov. 10, 1998; 34p; In English
Report No.(s): DE00-001658; DOE/FETC-98/1071; No Copyright; Avail: National Technical Information Service (NTIS)

This paper describes the performance of a gas generator used to synthesize the exhaust gas from the anode of a molten-carbonate fuel cell. The composition of this gas is estimated to be that of equilibrium at 1,250 F and 1 atm: 48% CO_2, 39% H_2O, 5% CO, and 8% H_2, with an energy content of approximately 39 Btu/scf (higher heating value). to synthesize a range of gas compositions around this point, the gas generator partially oxidizes a mixture of CH_4, O_2, and CO_2; to generate energy densities between 20 and 60 Btu/scf at temperatures between 1,198 and 1,350 F. Results show that the technique provides a relatively high ratio of CO to H_2 concentrations compared with the target composition (CO:H_2; of 2, versus 0.71). A detailed chemical model shows that the likely cause is quenching of the CO and H_2; chemistry below 2,000 F.
NTIS

Molten Carbonate Fuel Cells; Synthesis (Chemistry); Gas Generators; Oxidation; Exhaust Gases

20000073800 Energia Nucleare e Delle Energie Alternative, Centro Ricerche Casaccia, Rome, Italy

Fuel-cell technology for vehicular applications

Ciancia, A.; Pede, G.; Marmigi, R.; Dec. 31, 1998; 28p; In Italian; In English
Report No.(s): DE99-722876; ENEA-RT-ERG-98-03; No Copyright; Avail: Department of Energy Information Bridge

The fuel-cell technology applied to engines for vehicular applications grants broad margins of convenience over any known alternative engine for what concerns the compliance with any present and foreseeable environmental and energy saving regulations. On the other hand, the use of hydrogen produced on board from fuels or stored as a liquid or a gas, raises new problems from the point of view of safety regulations and standards both in the design and use of vehicles and in the fuel production and distribution. The present work is aimed at pointing out the above main safety problems, describes the technical-choices together with their technical grounds, in the framework of the Italian and U E standards and regulations. The report is then made up of three parts. The initial section where the on board storage of the fuel from technical-economical point of view is discussed, with particular reference to the compressed hydrogen. The second describing the regulations and standards holding in the field of on board pressure equipment and reporting the ongoing ENEA's activities in the field. The final part is devoted to the distribution and supply of the fuels to the fuel cell powered electric vehicles.

NTIS

Fuel Cells; Electric Motor Vehicles

20000073803 Risoe National Lab., Wind Energy and Atmospheric Physics Dept., Roskilde, Denmark

Statistical variation of wind turbine fatigue loads

Thomsen, K.; Sep. 30, 1998; 36p; In English

Report No.(s): DE99-717256; RISO-R-1063(EN); ISBN 87-550-2410-6; No Copyright; Avail: Department of Energy Information Bridge

The objective of this investigations is to quantify the statistical variation associated with fatigue loads for wind turbines. Based on aeroelastic calculations for a 1.5 MW stall regulated wind turbine, the variation is quantified, and parameters of importance for the statistical variation are investigated. The results illustrate that the coefficient of variation of the life time equivalent load range, for typical wind turbine load components, is of the order of magnitude 5%. This result is based on one 10 minute simulation for each of 10 wind speed intervals between 5 and 25 m/s. It is shown that the effect of mean stress level is of major importance in fatigue analysis. Furthermore, the influence of simulation length and turbulence intensity is illustrated. Finally, an estimate of the uncertainty of the life time equivalent loads is given in general terms.

NTIS

Wind Turbines; Fatigue (Materials)

20000073805 Kaiserslautern Univ., Forschungsschwerpunkt Materialwissenschaften, Germany

Development, optimization and characterization of thin film materials and structures of tetrahedrally bonded amorphous semiconductors II *Final Report*

Schroeder, B.; Oechsner, H.; Jul. 31, 1998; 119p; In German; In English

Report No.(s): DE99-716503; ETDE-DE-729; No Copyright; Avail: Department of Energy Information Bridge

In a comprehensive study, we have investigated the effect of the most important deposition parameters on the electronic and microstructural properties of a-Si:H films, deposited by the thermocatalytic CVD (TCCVD), also called hot wire (HW) CVD. Using relatively simple equipment, device-quality material can be deposited with high rates and large flexibility. With the invention of a special process control, the microstructural interface engineering, the thermocatalytic CVD a-Si:H material was integrated in solar cells with a conversion efficiency of up to 10.2%. This value was obtained without using highly reflecting rear contacts and unavoidable 'air breaks'. The knowledge about the relationship between microstructure and stability, which was gained during the investigation within the project, enabled us to reduce the degradation of solar cells containing HW-a-Si:H. In that way, solar cells with the same initial conversion efficiency but improved stability have been produced, depositing the HW-a-Si:H i-layer with moderate H-dilution. Also (mu)c-Si:H, a-SiGe:H, and a-Ge:H films could be deposited with large rates and high quality applying the TCCVD method. These materials which are important for stacked cell application could be integrated with good (a-SiGe:H) and less good effort ((mu)c-Si:H, a-Ge:H) into solar cell structures.

NTIS

Thin Films; Amorphous Silicon

20000074108 NASA Marshall Space Flight Center, Huntsville, AL USA

The Abacus/Reflector and Integrated Symmetrical Concentrator: Concepts for Space Solar Power Collection and Transmission

Carrington, Connie, NASA Marshall Space Flight Center, USA; Fikes, John, NASA Marshall Space Flight Center, USA; Gerry, Mark, NASA Marshall Space Flight Center, USA; Perkinson, Don, Sverdrup Technology, Inc., USA; [2000]; 1p; In English; 35th; 35th Intersociety Energy Conversion Engineering Conference, 23-27 Jul. 2000, Las Vegas, NV, USA; No Copyright; Avail: Issuing Activity; Abstract Only

New energy sources are vital for the development of emerging nations, and the growth of industry in developed economies. Also vital is the need for these energy sources to be clean and renewable. For the past several years, NASA has been taking a new look at collecting solar energy in space and transmitting it to Earth, to planetary surfaces, and to orbiting spacecraft. Several innovative concepts are being studied for the space segment component of solar power beaming. One is the Abacus/Reflector, a large sun-oriented array structure fixed to the transmitter, and a rotating RF reflector that tracks a receiving rectenna on Earth. This concept eliminates the need for power-conducting slip rings in rotating joints between the solar collectors and the transmitter. Another concept is the Integrated Symmetrical Concentrator (ISC), composed of two very large segmented reflectors which rotate to collect and reflect the incident sunlight onto two centrally-located photovoltaic arrays. Adjacent to the PV arrays is the RF transmitter, which as a unit track the receiving rectenna, again eliminating power-conducting joints, and in addition reducing the cable lengths between the arrays and transmitter. The metering structure to maintain the position of the reflectors is a long mast, oriented perpendicular to the equatorial orbit plane. This paper presents a status of ongoing systems studies and configurations for the Abacus/Reflector and the ISC concepts, and a top-level study of packaging for launch and assembly.
Author
Solar Arrays; Solar Collectors; Solar Energy Conversion; Solar Generators; Solar Power Satellites; Power Beaming

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ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20000068447 Department of Energy, National Energy Technology Lab., Morgantown, WV USA
LIMB Demonstration Project Extension and Coolside Demonstration: A DOE Assessment
Apr. 2000; 30p; In English
Report No.(s): PB2000-105843; DOE/NETL-2000/1123; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
Contents include the following: Executive Summary; Introduction; Technical and Environmental Assessment; Operating Capabilities Demonstrated; Market Analysis; Conclusions; Abbreviations and References.
NTIS
Air Pollution; Pollution Control; Sulfur Dioxides; Nitrogen

20000068450 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Photochemical Simulations of Point Source Emissions with the Models-3 CMAQ Plume-in-Grid Approach
Godowitch, J. M.; Young, J. O.; 2000; 18p; In English
Report No.(s): PB2000-105757; EPA/600/A-00/016; No Copyright; Avail: National Technical Information Service (NTIS)
A plume-in-grid (PinG) approach has been designed to provide a realistic treatment for the simulation of the dynamic and chemical processes impacting pollutant species in major point source plumes during a subgrid scale phase within an Eulerian grid modeling framework. The PinG science algorithms include a Plume Dynamics Model (PDM) processor and a Lagrangian plume module. Simulations were performed with the PinG treatment applied to a group of point sources exhibiting a wide range of NOx emission rates situated in a regional modeling domain encompassing Nashville, Tennessee. Selected plume model results are presented from a case study day from the Nashville/Middle Tennessee ozone study period during July 1995.
NTIS
Chemical Reactions; Contaminants; Photochemical Reactions; Plumes; Point Sources; Emission; Computerized Simulation

20000068451 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Air Quality Modeling of PM and Air Toxics at Neighborhood Scales
Ching, J.; 2000; 10p; In English
Report No.(s): PB2000-105756; EPA/600/A-00/018; No Copyright; Avail: National Technical Information Service (NTIS)
The current interest in fine particles and toxics pollutants provide an impetus for extending air quality modeling capability towards improving exposure modeling and assessments. Currently, the EPA emissions based modeling systems, Models-3 Community Multiscale Air Quality modeling system (CMAQ) is capable of modeling PM 2.5 and PM-10 at horizontal resolutions of approximately 36 km for regional to 4 km for urban scale predictions. In this presentation, a framework for extending the Models-3/CMAQ to be operable at a full range of scales from regional to the neighborhood scale for use in exposure modeling is described. As part of this study, methodologies and approaches envisioned to develop reational linkages with ambient and expo-

sure monitors to provide concentration fields as critical inputs to models of human exposure (and epidemiological studies) are discussed.
NTIS
Air Quality; Environment Models; Particulates; Air Pollution; Pollution Monitoring; Mathematical Models; Contaminants

20000068452 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Simulating Atmospheric Exposure Using an Innovative Meteorological Sampling Scheme
Schwede, D. B.; Petersen, W. B.; LeDuc, S. K.; 2000; 6p; In English
Report No.(s): PB2000-105755; EPA/600/A-00/015; No Copyright; Avail: National Technical Information Service (NTIS)

To analyze the impact of ISCST3 estimates of using the sampled meteorological data, we made model runs using five area sources and two point sources. The sources varied in size and particle size distribution. Each source was run with 5 years of meteorological data for four stations: Lake Charles, LA; Pittsburgh, PA; Salem, OR, and Tucson, AZ. The sites were selected to provide a diversity of climatological regimes. A polar grid of receptors along 16 evenly spaced radials at distances ranging from the edge of the source to several kilometers was used. We compared the results of various combinations of sampling rates with the results from using the full meteorological database.
NTIS
Air Pollution; Computerized Simulation; Exposure; Meteorological Parameters; Point Sources; Sampling; Climatology; Mathematical Models

20000068453 Connecticut Univ., Dept. of Civil and Environmental Engineering, Storrs, CT USA
Use of Wood Waste Materials for Erosion Control *Final Report*
Demars, K. R.; Long, R. P.; Ives, J.; Apr. 2000; 70p; In English; Sponsored in part by New England Transportation Consortium
Report No.(s): PB2000-105139; No Copyright; Avail: National Technical Information Service (NTIS)

Three wood waste materials were evaluated for use as an erosion control mulch and one of the materials was used as an erosion control filter berm. Samples of the three materials were subjected to laboratory tests to determine their physical and chemical properties for comparison with the CONEG specifications for these erosion control applications. Each of the materials was subjected to large scale erosion control testing at a field site with a slope of 1 vertical to 2 horizontal. Fourteen test cells (5' W x 30' L each) were prepared with different wood waste treatments; nine contained erosion control mulch applications at thicknesses of 3/4 to 3 inch. Two cells were left untreated as reference cells and three other cells were untreated but contained erosion control structures including wood waste filter berm, geosynthetic silt fence and hay bale silt barrier. The erosion control performance of each cell treatment was evaluted for eleven storm events of varying rainfall magnitude and intensity. Calibrated tipper buckets were used to measure the runoff from each cell and collection buckets were used to sample runoff and determine the mass of sediment eroded from each cell. Total rainfall and intensity of each storm was measured with an electronic rain gauge.
NTIS
Erosion; Wood; Waste Treatment

20000068531 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
GENESIS: GPS Environmental and Earth Science Information System
Hajj, George, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 9p; In English; Leo Missions, 9-11 Mar. 1999, Potsdam, Germany; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This presentation reviews the GPS ENvironmental and Earth Science Information System (GENESIS). The objectives of GENESIS are outlined (1) Data Archiving, searching and distribution for science data products derived from Space borne Turbo-Rogue Space Receivers for GPS science and other ground based GPS receivers, (2) Data browsing using integrated visualization tools, (3) Interactive web/java-based data search and retrieval, (4) Data subscription service, (5) Data migration from existing GPS archived data, (6) On-line help and documentation, and (7) participation in the WP-ESIP federation. The presentation reviews the products and services of Genesis, and the technology behind the system.
CASI
Global Positioning System; Information Systems; On-Line Systems; Earth Sciences

20000068966 Minnesota Univ., Dept. of Mechanical Engineering, Minneapolis, MN USA
On-Board Emissions and Performance Measurement System (OEPMS) for Measuring Carbon Monoxide Emissions during Cold Starting *Final Report, 1999-1999*
Johnson, J. P.; Kittelson, D. B.; May 1999; 50p; In English
Report No.(s): PB2000-105204; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the results of a project to develop an on-board emissions and performance measurement system (OEPMS) for the quantification of carbon monoxide (CO) emissions. Researchers measured emissions from a 1990, 2.5 liter TBI engine passenger automobile over a typical suburb-to-city commute in the Minneapolis/St.Paul metropolitan area. As a test of the OEPMS, researchers measured CO emissions during cold weather cold starts and commutes at temperatures characteristic of the area's winter weather. Open-loop and closed-loop emissions of CO were measured and compared. Additionally, the effectiveness of magnetic-type block heaters was examined.

NTIS

Carbon Monoxide; Onboard Equipment; Pollution Monitoring

20000068999 NASA Ames Research Center, Moffett Field, CA USA

Biomass Burning Influences on the Composition of the Remote South Pacific Troposphere: Analysis Based on Observations from PEM Tropics-A

Singh, H. B., NASA Ames Research Center, USA; Viezee, W., NASA Ames Research Center, USA; Chen, Y., NASA Ames Research Center, USA; Bradshaw, J., Georgia Inst. of Tech., USA; Sandholm, S., Georgia Inst. of Tech., USA; Blake, D., California Univ., USA; Blake, N., California Univ., USA; Heikes, B., Rhode Island Univ., USA; Snow, J., Rhode Island Univ., USA; Talbot, R., New Hampshire Univ., USA; Sachse, G., NASA Langley Research Center, USA; Vay, S., NASA Langley Research Center, USA; [1999]; 21p; In English

Contract(s)/Grant(s): RTOP 622-63-01-10; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Airborne, in-situ measurements from PEM-Tropics-A (September/October 1996) are analyzed to show the presence of distinct pollution plumes in the middle-tropical troposphere of the remote South Pacific (10-30degS). These elevated plumes cause a relative maximum at about 5-7km attitude in the vertical distribution of primary and secondary species characteristic of fuel combustion and biomass burning (CO, C2H2, C2H6, CH3Cl, PAN, O3). Similar plumes were also observed at mid-latitudes in the middle troposphere during three flights east of New Zealand (40-45degS). In all, pollution plumes with CO larger than 100 ppb were observed 24 times on 7 separate flight days south of the equator. The observed plumes were generally embedded in very dry air. Ten-day back trajectory analysis supports the view that these originated from the biomass burning regions of South Africa (and South America) and were transported to the South Pacific along long-distance subsiding trajectories. The chemical composition of the southern Pacific troposphere analyzed from the PEM-Tropics-A data is compared with data from the tropical regions of the northern Pacific (PEM-West-A) and southern Atlantic (TRACE-A) during the same Sept/Oct time period. Sizable perturbations in the abundance of ozone and its key precursors, resulting from the transport of pollution originating from biomass burning sources, are observed in much of the Southern Hemispheric troposphere.

Author

Troposphere; Chemical Composition; Plumes; Methyl Chloride; Ethane; Acetylene

20000069354 California Univ., Los Angeles, CA USA

Analysis of Weekday/Weekend Differences in Ambient Air/Quality and Meteorology in the South Coast Air Basin *Final Report*

Blier, W.; Winer, A. M.; Hansen, D.; Chavira, R.; Jun. 1999; 192p; In English

Report No.(s): PB2000-102428; No Copyright; Avail: National Technical Information Service (NTIS)

The second study to understand the day-of-the-week effects where weekend days have higher ozone concentrations coincident with lower precursor emissions suggests that carryover of pollutants from Friday evening to Saturday may be of greater significance than that occurring during other days of the week. These limited ground observations suggest a weak carryover effect for NOx and NO2. During 1994/95 Saturdays and Sundays, concentration reduction of non-methane hydrocarbons (NMHC) and NOx coincide with increases in ozone. However, 1986-96 ozone concentrations have declined significantly coincident with significant reductions in levels of NMHC and NOx. Day-of-the-week effect does not provide evidence that further NOx control is counterproductive to further ozone reductions. Further exploring if human activities generate day-of-the-week influences in meteorological parameters, UCLA investigators noted aerosol concentrations and ambient temperatures have a weak day-of-the-week influence. They further noted that recent years seem to indicate a shift to later and shorter ozone seasons and a shift to Sunday being the highest ozone peak day-of-the-week.

NTIS

Air Quality; Coasts; Structural Basins; Ambience; Hydrocarbons; Exhaust Gases; Meteorological Parameters

20000069355 Fisk (William J.), Oakland, CA USA

Indoor Air Technology in the USA

Seppaenen, O., Fisk (William J.), USA; Apr. 03, 1999; 114p; In English

Report No.(s): PB2000-102674; No Copyright; Avail: National Technical Information Service (NTIS)

The report provides a brief discussion of current US practice. For some topics, current trends and anticipated future practice are also discussed. To perform this review, the author has gathered information through computerized bibliographic searches, reviews of conference proceedings and files of literature, reviews of available statistical date on building and HVAC characteristics, and discussions with numerous experts.

NTIS

Indoor Air Pollution; Design Analysis; Air Quality

20000069357 Atmospheric and Environmental Research, Inc., San Ramon, CA USA

Review of the Emissions, Atmospheric Chemistry, and Gas/Particle Partition of Biogenic Volatile Organic Compounds and Reaction Products *Final Report*

Lamb, B.; Grosjean, D.; Pun, B.; Seigneur, C.; Nov. 1999; 218p; In English

Report No.(s): PB2000-102875; AER-CP051-1B-99; No Copyright; Avail: National Technical Information Service (NTIS)

This document reviews the state of knowledge in several areas related to the effects of biogenic volatile organic compounds (BVOC) in the ambient atmosphere and provides a summary of the current knowledge gaps. Following a brief introduction, Sections 2, 3, and 4 address the emissions of BVOC, the chemical fate of these compounds and their secondary products, and the partition of condensible products between the gas and particle phases, respectively. Knowledge gaps are summarized in Section 5, which also provide the authors' recommendations for future work.

NTIS

Atmospheric Chemistry; Reaction Products; Volatile Organic Compounds; Emission; Particulates; Pollution Monitoring

20000069371 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

Economic Impact Analysis for the Final Secondary Aluminum Production National Emission Standard for Hazardous Air Pollutants

Chappell, L. M.; King, J.; Dec. 1999; 156p; In English

Report No.(s): PB2000-102873; EPA/452/R-99/006; No Copyright; Avail: National Technical Information Service (NTIS)

This report evaluates the impacts of the final rule for controls of hazardous air pollutants (HAPs) in the Secondary Aluminum industry. Social costs are estimated by evaluating costs of compliance with the rule and associated market impacts including: potential price changes in secondary aluminum, possible changes in the quantity of secondary aluminum produced, small entity impacts, and employment impacts.

NTIS

Air Pollution; Economic Impact; Secondary Emission; Contaminants; Pollution Control

20000069372 Pacific Environmental Services, Inc., Research Triangle Park, NC USA

Iron and Steel Foundries Manual Emissions Testing Cupola Wet Scrubber General Motors Corp., Saginaw, Michigan, Volume 1 *Final Report*

Jul. 1999; 700p; In English

Report No.(s): PB2000-102924; EPA/454/R-99/025; No Copyright; Avail: National Technical Information Service (NTIS)

The USA Environmental Protection Agency (EPA) is investigating iron and steel foundries to identify and quantify hazardous air pollutants (HAPs) emitted from cupolas; electric arc furnaces; and pouring, cooling and shakedown operations of sand mold casting processes. General Motors Corporation, Saginaw Casting Operations (GMC), Saginaw, Michigan was selected by the EPA as the host facility at which to (1) characterize HAP emissions from cupolas that are controlled by wet scrubbers, and (2) assess wet scrubber performance in controlling HAP emissions from cupolas. This report presents the results of a manual emissions testing program to characterize emissions from a cupola and assess the performance of the wet scrubber in controlling HAP emissions. Testing was conducted at the cupola wet scrubber inlet and outlet to determine air emissions of particulate matter (PM) and metal HAPs; and at the cupola wet scrubber outlet to determine organic HAPs consisting of dibenzo-p-dioxins and polychlorinated dibenzodurans (PCDDs/PCDFs) and semi-volatile organic hazardous air pollutants (SVOHAPs), and volatile organic hazardous air pollutants (VOHAPs). The data may be used by the EPA as potential Maximum Achievable Control Technology (MACT) floor technology for cupolas.

NTIS

Foundries; Emission; Scrubbers; User Manuals (Computer Programs); Environment Protection

20000069373 Pacific Environmental Services, Inc., Research Triangle Park, NC USA

Iron and Steel Foundries Manual Emissions Testing Cupola Wet Scrubber General Motors Corp., Saginaw, Michigan, Volume 2 *Final Report*

Jul. 1999; 496p; In English

Report No.(s): PB2000-102925; EPA/454/R-99/026B; No Copyright; Avail: National Technical Information Service (NTIS)

Table of Contents: Appendix C - Analytical Data, Particulate Matter and Metals; Appendix D - Calculations; Appendix E - QA/QC Data; and Appendix F - Participants.

NTIS

Foundries; Emission; Scrubbers; Quality Control

20000069375 Environmental Protection Agency, Air Pollution Prevention and Control Div., Research Triangle Park, NC USA

Managing Indoor Air Quality in the USA

Tucker, W. G.; 2000; 12p; In English; Clean Technology and Management for Indoor Air, 11 Nov. 1999, Seoul, Korea, Republic of

Report No.(s): PB2000-102945; EPA/600/A-99/095; No Copyright; Avail: National Technical Information Service (NTIS)

The paper gives an overview of managing indoor air quality (IAQ) in the US IAQ is managed through various governmental regulations on products that might affect IAQ; isolated governmental regulations on specific pollutants; guidelines in voluntary consensus standards that are prepared largely by private-sector groups and that may influence building codes; self-regulation by product manufacturers who are concerned about the role their products have on IAQ and who want to prevent adverse marketplace forces; and public information documents prepared by both governmental bodies and public interest groups. Examples of each of these activities are presented.

NTIS

Indoor Air Pollution; Conferences; Air Quality; Pollution Control; Quality Control

20000069376 Research Triangle Inst., Research Triangle Park, NC USA

Environmental Technology Verification for Indoor Air Products

Franke, D. L.; Sparks, L. E.; Ensor, D. S.; 1999; 10p; In English; 1st; Indoor Air Health, 3-5 May 1999, Denver, CO, USA; Sponsored by National Science Foundation, USA

Report No.(s): PB2000-102946; EPA/600/A-99/094; No Copyright; Avail: National Technical Information Service (NTIS)

The paper discusses environmental technology verification (ETV) for indoor air products. RTI is establishing test protocols for products that fit into three categories: those that have reduced emissions because of pollution prevention efforts, those that control contamination, and those that provide instrumentation for indoor environment measurements. Stakeholder groups of industry, government, and other interested organizations provide input and review the protocols. Industry requested multiple test laboratories; therefore, RTI developed a laboratory proficiency program. The testing framework is available to private trade associations and testing laboratories as a basis for establishing their own programs. The initial programs looked at emissions from commercial furniture and contamination control efficiency from general ventilation air filters and electronic air cleaners.

NTIS

Pollution Control; Indoor Air Pollution

20000069377 Eastern Research Group, Inc., Morrisville, NC USA

Prototype Tool for Evaluating the Cost and Effectiveness of Greenhouse Gas Mitigation Technologies

Beck, L.; Burklin, C. E.; 1999; 16p; In English; Air and Waste Management Association Emissions Inventory, 28 Oct. 1999, Raleigh, NC, USA

Report No.(s): PB2000-102947; EPA/600/A-99/093; No Copyright; Avail: National Technical Information Service (NTIS)

The paper introduces the structure of a tool, being developed by the US EPA's Office of Research and Development, that will be able to analyze the benefits of new technologies and strategies for controlling greenhouse gas (GHG) emissions. When completed, the tool will be able to evaluate future emissions of GHG and releases of co-pollutants from all sectors of anthropogenic activity. It will also be able to estimate the cost of the choices. Results will be computed from technology and strategy choices selected by the model's user. The design will be able to facilitate the review of all assumptions and functions. It also will allow modifications to these structures to meet individual researcher's needs. The paper also summarizes the tool's capabilities and limitations, and provides information on the availability of the tool to researchers.

NTIS

Greenhouse Effect; Exhaust Gases; Pollution Control; Software Development Tools

20000069378 Georgia Tech Research Inst., Atlanta, GA USA

Source Characterization of Consumer Aerosol Products

Bayer, C. W.; Browner, R. A.; Ho, Z. S.; 1999; 10p; In English; 7th; Indoor Air Quality and Climate, 21-26 Jul. 1996, Nagoya, Japan; Portions of this document are not fully legible

Report No.(s): PB2000-102948; EPA/600/A-99/092; No Copyright; Avail: National Technical Information Service (NTIS)

The paper discusses source characterization of consumer aerosol products. Under a US EPA cooperative agreement, an Aerosol Mass Spectral Interface has been developed that will characterize the particulate and gaseous phases of a consumer aerosol product. The Interface uses velocity differences between particle sizes to determine aerosol particle sizes, a series of skimmers, and particle beams to focus the aerosol for mass spectral analysis. When the Interface is used in conjunction with a liquid chromatograph (LC)/mass spectrometer (MS) or LC/MS/MS system, it is possible to chemically characterize a consumer aerosol product.

NTIS

Aerosols; Consumers; Characterization

20000069380 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

TRIM: Total Risk Integrated Methodology. TRIM.FaTE: Technical Support Document, Volume 1, Description of Module. External Review Draft

Nov. 1999; 172p; In English

Report No.(s): PB2000-102957; EPA/453/D-99/002A; No Copyright; Avail: National Technical Information Service (NTIS)

The first volume provides a description of the terminology, model framework, and functionality of TRIM.FaTE. Specifically, Chapter 2 provides an overview of the development and features of TRIM.FaTE, Chapters 3 and 4 discuss the TRIM.FaTE terminology and conceptual design, Chapter 5 provides a general description of how the conceptual design is implemented in TRIM.FaTE, and Chapter 6 explains the treatment of uncertainty and variability in TRIM.FaTE.

NTIS

Risk; Terminology

20000069381 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

TRIM: Total Risk Integrated Methodology. Status Report

Nov. 1999; 156p; In English

Report No.(s): PB2000-102959; EPA/453/R-99/010; No Copyright; Avail: National Technical Information Service (NTIS)

Table of Contents: Introduction; May 1998 Science Advisory Board Review and Agency Responses; Treatment of Uncertainty and Variability in TRIM; Revisions and Additions to TRIM.FaTE; Current Status of TRIM.FaTE; Evaluation Plan for TRIM.FaTE; TRIM.FaTE Mercury Case Study; Development of TRIM.Expo; General Description and Conceptual Design of TRIM.Risk; Development of TRIM Computer Framework; References; Appendices-Glossary; Review of Methods for Conducting Uncertainty Analyses; Input Values Being Developed for TRIM.FaTE Mercury Case Study; and Summary of Available Monitoring Data for TRIM.FaTE Mercury Case Study.

NTIS

Risk; Methodology

20000069775 Arizona Univ., Dept. of Chemical and Environmental Engineering, Tucson, AZ USA

Environmental Control of Toxic Metal Air Emissions from the Combustion of Coal and Wastes

Wendt, J. O. L.; Davis, S. B.; Gale, T. K.; Seames, W. S.; Linak, W. P.; Jan. 2000; 18p; In English; Energy engineering in the 21st Century, 9-13 Jan. 2000, Hong Kong

Report No.(s): PB2000-102971; EPA/600/A-00/001; No Copyright; Avail: National Technical Information Service (NTIS)

Toxic metals, such as arsenic, selenium, mercury, chromium, lead, and cadmium, are present in coals and in many municipal and industrial wastes. This paper is concerned with the partitioning of these metals during combustion, and with the mitigation of their effect on the environment using high temperature sorbents. The partitioning of arsenic and selenium during coal combustion in a 17 kW laboratory down-fired furnace is discussed, and appropriate mechanisms identified. Second, the speciation of mercury and chromium during combustion is addressed, through special experiments on an 82 kW refractory-lined combustor. Third, experimental results on the sorption of individual and multiple metals on sorbents are presented. These sorbents were kaolinite and lime, and were injected directly into flue gas containing lead and cadmium, which had vaporized in the main flame. Results suggest that toxic metals from coal and waste combustion can interact with lime and kaolinite sorbents and that, for some

multiple metal mixtures, designer sorbents containing calcium, aluminum, and silicon might be useful to capture them and render them environmentally benign.
NTIS
Emission; Combustion; Environment Effects; Pollution Control; Combustion Products

20000069781 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Economic Impact Analysis of Proposed Commercial and Industrial Solid Waste Incineration Regulation
Nov. 1999; 118p; In English
Report No.(s): PB2000-103409; EPA/452/R-99/004; No Copyright; Avail: National Technical Information Service (NTIS)

The US Environmental Protection Agency (EPA) is developing regulations under Sections 111 and 129 of the Clean Air Act for commercial and industrial incineration units that burn nonhazardous solid waste materials. Control measures implemented to comply with the proposed regulation will impose regulatory costs on affected facilities in the commercial, industrial, and government sectors. This study evaluates the impact (both negative and positive) of these costs on facilities, on the parent companies that own the facilities, and on the US economy. Control costs associated with the Floor Alternative for the proposed CISWI regulation are estimated to be approximately $11.6 million. The analysis also suggests that the proposed regulation should not generate significant small business impacts on a substantial number of small firms in the commercial, industrial, and govenrment sectors.
NTIS
Environment Protection; Economic Impact; Industrial Wastes; Air Quality; Waste Treatment; Pollution Control

20000069786 Southwest Region Univ. Transportation Center, College Station, TX USA
Assessment of Potential Energy Savings and Other Benefits from Alternative Fuel Utilization and Employer Trip Reduction Programs *Topical Report*
Goodwin, R. E.; Lewis, C. A.; Apr. 2000; 54p; In English
Report No.(s): PB2000-105203; SWUTC/00/466070-1; No Copyright; Avail: National Technical Information Service (NTIS)

By passing the Clean Air Act Amendments of 1990 (CAAA) our government intensified efforts to improve the declining air quality in many of our nation's cities. The passage of the CAAA also signaled the acknowledgement that American commuters must modify travel patterns and behavior. Areas defined as non-attainment by the Environmental Protection Agency must improve their air quality to satisfactory levels or face possible punitive sanctions imposed by the federal government. In response to the changing demands of urban mobility, city and transportation officials aggressively began pursuing alternative fuels programs in fleet vehicles as a means to improve air quality. In addition to the successful conversions of vehicle fleets to alternative fuels, transportation officials proceeded to influence home-to-work trips thereby improving air quality through the employer trip reduction programs. While air quality improvements are the impetus for increasing alternative fuels technology and trip reduction, there are other unexpected benefits that are beginning to be realized. This research seeks to establish parameters for the measurements of such ancillary benefits beyond alternative fuels and employer trip reduction programs.
NTIS
Potential Energy; Fuels; Energy Conservation; Energy Policy; Air Quality; Environment Protection; Project Management

20000069793 Minnesota Pollution Control Agency, Policy and Planning Div., Saint Paul, MN USA
Report on the Mercury Contamination Reduction Initiative Advisory Council's Results and Recommendations
Mar. 1999; 96p; In English
Report No.(s): PB2000-105813; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The Mercury Contamination Reduction Initiative is a Minnesota Pollution Control Agency (MPCA) project aimed at reducing mercury contamination of fish in Minnesota lakes. As part of the initiative, the MPCA formed an Advisory Council to develop recommendations on mercury-reduction strategies for the agency's consideration. The purpose of this report is to document and recommend implementation of the strategies adopted by the Advisory Council.
NTIS
Contamination; Mercury (Metal); Pollution Control; Water Treatment; Waste Water

20000069794 Department of Energy, National energy Technology Lab., Morgantown, WV USA
Confined Zone Dispersion Project: A DOE Assessment
Nov. 1999; 24p; In English
Report No.(s): PB2000-105816; DOE/NETL-2000/1112; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This document serves as a U.S. Department of Energy (DOE) post-project assessment of a project in Clean Coal Technology (CCT) Round 3, entitled 'Confined Zone Dispersion Project.' In 1990, Bechtel Corporation entered into an agreement to conduct this project with the Seward Power Station of Pennsylvania Electric Company (now GPU Genco) serving as the host site. DOE provided 43 percent of the total project cost of $12 million. Other participants were the Pennsylvania Energy Development Authority (PEDA), the New York State Electric and Gas Corporation (NYSEG), and the Rockwell Lime Company. The DOE-sponsored demonstration was conducted between June 1990 and June 1993, with Bechtel supporting additional testing in early 1994. The Confined Zone Dispersion (CZD) process is a flue gas desulfurization (FGD) process designed to remove sulfur dioxide (SO_2) produced in a coal-fired utility boiler. The process involves injecting a finely atomized slurry of reactive lime into the duct work. The lime in the slurry droplets reacts with SO_2 in the gas, and the reaction products dry to form solid particles. An electrostatic precipitator (ESP) downstream from the point of injection captures the reaction products, along with the fly ash entrained in the flue gas. The CZD process is technically simple and, because it is relatively easy to retrofit with existing equipment, had been projected to have lower capital cost than other FGD processes. The primary objectives of this project were to: demonstrate an SO_2 removal rate of 50 percent with 50-percent sorbent utilization; achieve projected commercial scale SO_2 removal costs $300/ton; and ensure that there are no negative effects on normal boiler operations, such as increased particulate emissions or opacity.
NTIS
Flue Gases; Fossil Fuels; Desulfurizing; Pollution Control

20000070362 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Climate Variability Program *Annual Report, 1998*
Halpern, David, Editor, Jet Propulsion Lab., California Inst. of Tech., USA; April 1999; 60p; In English; See also 20000070363 through 20000070394
Contract(s)/Grant(s): NAS7-1407
Report No.(s): JPL-Publ-99-7; No Copyright; Avail: Issuing Activity; Abstracts Only
    The Annual Report of the Climate Variability Program briefly describes research activities of 40 Principal Investigators who are funded by NASA's Earth Science Enterprise Research Division. The report is focused on the year 1998. Utilization of satellite observations is a singularity of research on climate science and technology at JPL. Research at JPL has two foci: generate new knowledge and develop new technology.
Author
Satellite Observation; Climate Change; Climatology; Earth Sciences; Meteorology; Oceanography

20000070380 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Characterization of Climate Change and Variability with GPS
Kursinski, R., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 26; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document
    We compared zonal mean specific humidity derived from the 21 June-4 July 1995 Global Positioning System (GPS)/MET occultation observations with that derived from the European Center for Medium-Range Weather Forecasts (ECMWF) global analyses. The GPS/MET results indicate a drier troposphere, especially near the subtropical tradewind inversion. A small, moist bias in the GPS/MET upper northern-hemisphere troposphere compared to ECMWF may be due to a small radiosonde temperature bias. A diagram shows the difference (g/kg) between the GPS/MET zonal mean specific humidity and that for June-August derived from 1963-1973 radiosondes. Although the observing period is short, GPS and ECMWF results both indicate a significantly wetter boundary layer at most latitudes consistent with decadal trends observed in radiosonde data. GPS/MET results exhibit higher tropical convective available potential energy (CAPE), suggesting a more vigorous tropical Hadley circulation. Drier, free troposphere air in the descending branches of the Hadley circulation is due in part to a moist radiosonde bias but may also reflect some negative moisture feedback. Using 1992-1997 ground GPS observations and recent advancements in GPS technology, we removed an apparent altimetric drift (-1.2 +/- 0.4 mm/yr) due to columnar water vapor from the Topography (Ocean) Experiment (TOPEX) microwave radiometer, which brought the TOPEX mean sea level change estimates into better agreement with historical tide gauge records, suggesting global mean sea level is rising at a rate of 1.5-2.0 mm/yr. We can also discern a statistically significant increase of 0.2 +/- 0.1 kg/square m/yr in mean columnar water vapor over the ocean from 1992-1997. Optimal fingerprinting can be used for the detection and attribution of tropospheric warming due to an anthropogenic greenhouse. Optimal fingerprinting distinguishes between different types of signals according to their spatial and temporal patterns, while minimizing the influence of natural climate variability. S. Leroy concludes that the signal-to-noise ratio of global warming detection increases by unity approximately every 10 years if a single oceanic region is chosen. Less time for detection is likely when many global regions are considered simultaneously. GPS occultation constellations allow the possibility of

detecting small changes in upper air temperature with inconsequential calibration errors, making occultation an ideal data type for global warming detection studies. Our initial study of a 22-GHz satellite-satellite occultation system predicts upper troposphere moisture sensitivities of 3-5 ppmv and 1-2 percent in the middle and lower troposphere. Additional information contained in original.

Author

Atmospheric Temperature; Climate Change; Global Warming; Troposphere; Water Vapor

20000070385 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Ocean-Atmosphere Interaction in Climate Changes

Liu, W. Timothy, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 31; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The diagram, which attests the El Nino teleconnection observed by the NASA Scatterometer (NSCAT) in 1997, is an example of the results of our research in air-sea interaction - the core component of our three-part contribution to the Climate Variability Program. We have established an interplay among scientific research, which turns spacebased data into knowledge, a push in instrument technology, which improves observations of climate variability, and an information system, which produces and disseminates new data to support our scientific research. Timothy Liu led the proposal for advanced technology, in response to the NASA Post-2002 Request for Information. The sensor was identified as a possible mission for continuous ocean surface wind measurement at higher spatial resolution, and with the unique capability to measure ocean surface salinity. He is participating in the Instrument Incubator Program to improve the antenna technology, and is initiating a study to integrate the concept on Japanese missions. He and his collaborators have set up a system to produce and disseminate high level (gridded) ocean surface wind/stress data from NSCAT and European missions. The data system is being expanded to produce real-time gridded ocean surface winds from Quikscat, and precipitation and evaporation from the Tropical Rain Measuring Mission. It will form the basis for a space-based data analysis system which will include momentum, heat and water fluxes. The study on 1997 El Nino teleconnection illustrates our interdisciplinary and multisensor approach to study climate variability. The diagram shows that the collapse of trade wind and the westerly wind anomalies in the central equatorial Pacific led to the equatorial ocean warming. The equatorial wind anomalies are connected to the anomalous cyclonic wind pattern in the northeast Pacific. The anomalous warming along the west coast of the USA is the result of the movement of the pre-existing warm sea surface temperature anomalies with the cyclonic wind anomalies toward the coast. The results led to a new study which identifies decadal ocean variations in the Northeast Pacific. Three studies of oceanic responses to wind forcing caused by the seasonal change of monsoons, the passage of a typhoon, and the 1997 El Nino, were successfully conducted. Besides wind forcing, we continue to examine new techniques for estimating thermal and hydrologic fluxes, through the inverse ocean mixed-layer model, through divergence of atmospheric water transport, and by direct retrieval from radiances observed by microwave radiometers. Greenhouse warming has been linked to water vapor measured by two spaceborne sensors in two studies. In the first study, strong baroclinicity and deep convection were found to transport water vapor to the upper atmosphere and increase greenhouse trapping over the storm tracks of the North Pacific and Atlantic. In another study, the annual cycle of greenhouse warming were related to sea surface temperature (SST) and integrated water vapor, and the latitudinal dependence of the magnitudes and phases of the annual cycles were compared.

Author

Air Water Interactions; Climate Change; Data Systems; El Nino; Greenhouse Effect; Marine Meteorology; Ocean Surface; Sea Surface Temperature; Teleconnections (Meteorology); Tropical Meteorology; Tropical Regions

20000070471 Columbia Univ., New York, NY USA

Modeling Studies of the Effects of Winds and Heat Flux on the Tropical Oceans *Final Report*

Seager, R., Columbia Univ., USA; [1999]; 4p; In English

Contract(s)/Grant(s): NAGW-916; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Over a decade ago, funding from this NASA grant supported the development of the Cane-Zebiak ENSO prediction model which remains in use to this day. It also supported our work developing schemes for modeling the air-sea heat flux in ocean models used for studying climate variability. We introduced a succession of simple boundary layer models that allow the fluxes to be computed internally in the model and avoid the need to specify the atmospheric thermodynamic state. These models have now reached a level of generality that allows modeling of the global, rather than just tropical, ocean, including sea ice cover. The most recent versions of these boundary layer models have been widely distributed around the world and are in use by many ocean modeling groups.

Author

Mathematical Models; Heat Flux; Tropical Regions; Oceans; Air Water Interactions; Wind (Meteorology)

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20000070490 Zapata Engineering, Charlotte, NC USA

Transportation Conformity: We're All In This Together. Student Manual. FHWA Eastern Resource Center. Workshop Development/Presentation

Koontz, M.; 1999; 124p; In English

Contract(s)/Grant(s): DTFH61-97-Z-00065

Report No.(s): PB2000-105162; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

The Clean Air Act and the Intermodal Surface Transportation Efficiency Act (ISTEA), and more recently the Transportation Equity Act for the 21st Century (TEA-21), brought together the two issues of air quality and transportation. An important concern is the quality of the air you breath. A common misconception is that 'only the big cities have problems'. Over the past 20 years, emphasis for cleaning the air has been focused on the larger urban areas like Los Angeles, New York, Chicago, etc. in the past, air pollution was seen only as an urban problem, not a local or rural one. But this is no longer true. More and more often, rural areas experience air quality problems. Many rural areas that are in 'fringe communities' may now be classified as nonattainment areas. These areas must become familiar with the transportation conformity issue and how it affects them.

NTIS

Air Pollution; Air Quality; Transportation; Environment Effects

20000070660 Morgan State Univ., National Transportation Center, Baltimore, MD USA

Estimation of Mobile Emissions Reduction from Using Electronic Toll Collection in the Baltimore Metropolitan Area: A Case Study of the Fort McHenry Tunnel Toll Plaza

Saka, A. A., Morgan State Univ., USA; Agboh, D. K., Morgan State Univ., USA; Ndiritu, S., Morgan State Univ., USA; Glassco, R. A., Morgan State Univ., USA; Mar. 2000; 32p; In English

Report No.(s): PB2000-105915; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The Baltimore Metropolitan Area is classified as a severe nonattainment areas under the Clean Air Act Amendments of 1990. One of the newest emissions control schemes in the Baltimore area is the deployment of electronic toll collection (ETC) technology, locally known as M-Tag, at the three toll facilities (the Fort McHenry, Baltimore Harbor, and Key Bridge toll plazas). The objectives of the study described are twofold. First, a microscopic simulation model was used to simulate the existing traffic situations at the Fort McHenry Tunnel toll facility, which is the largest toll plaza in the State of Maryland. Observed field data were used to validate simulation results. Second, the benefits inherent in the use of ETC technology were captured by undertaking a comparative analysis of pre-ETC and post-ETC scenarios. The primary measures of effectiveness used were: (1) increased throughput and hence reduced wait time at the toll plazas, and (2) reduced mobile emissions (hydrocarbon, carbon monoxide, and nitrogen oxide).

NTIS

Air Pollution; Pollution Monitoring; Air Quality; Traffic; Exhaust Emission

20000070666 Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC USA

RCRA, Superfund, and EPCRA Hotline Training Module: Introduction to Boilers and Industrial Furnaces (40 CFR Part 266, Subpart H)

Feb. 2000; 24p; In English

Report No.(s): PB2000-101882; EPA/530/R-99/042; No Copyright; Avail: National Technical Information Service (NTIS)

The module summarizes the regulations affecting hazardous waste processes in boilers and industrial furnaces (BIFs). It defines BIFs and describes the criteria associated with the definitions. It describes the requirements for processing hazardous waste in BIFs, including the distinctions between permitted and interim status units. The module explains the requirements for the specially regulated BIF units and gives examples of each.

NTIS

Boilers; Environmental Cleanup; Furnaces; Hazardous Wastes; Waste Treatment

20000070725 NASA Goddard Space Flight Center, Greenbelt, MD USA

Arctic Climate and Atmospheric Planetary Waves

Cavalieri, D. J., NASA Goddard Space Flight Center, USA; Haekkinen, S., NASA Goddard Space Flight Center, USA; [2000]; 12p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Analysis of a fifty-year record (1946-1995) of monthly-averaged sea level pressure data provides a link between the phases of planetary-scale sea level pressure waves and Arctic Ocean and ice variability. Results of this analysis show: (1) a breakdown of the dominant wave I pattern in the late 1960's, (2) shifts in the mean phase of waves I and 2 since this breakdown, (3) an eastward shift in the phases of both waves I and 2 during the years of simulated cyclonic Arctic Ocean circulation relative to their phases

during the years of anticyclonic circulation, (4) a strong decadal variability of wave phase associated with simulated Arctic Ocean circulation changes. Finally, the Arctic atmospheric circulation patterns that emerge when waves 1 and 2 are in their extreme eastern and western positions suggest an alternative approach to determine significant forcing patterns of sea ice and high-latitude variability.

Author

Arctic Regions; Atmospheric Circulation; Planetary Waves; Sea Level; Pressure; Data Acquisition

20000070756 Illinois Univ., Dept. of Civil and Environmental Engineering, Urbana-Champaign, IL USA

Carbon Monoxide Analysis for Highway Projects *Final Report, Apr. 1998 - Oct. 1999*

Larson, S. M.; Coleman, F.; Peters, S.; Gollapalli, P. K.; October 1999; 176p; In English

Report No.(s): PB2000-106017; ITRC-FR-97-2; No Copyright; Avail: CASI; A02, Microfiche; A09, Hardcopy

Air quality analysis for highway projects are conducted to determine if projects have the potential to cause exceedances of the National Ambient Air Quality Standars (NAAQS). Prior to construction, detailed air quality modeling analysis are often used to estimate a project's impact on the ambient concentration of atmospheric pollutants. One pollutant of concern is carbon monoxide (CO). Because the NAAQS for CO are expressed as maximum concentrations not to be exceeded more than once a year, a screening analysis may be an appropriate tool which can be used to determine if a detailed analysis is necessary. The screening analysis is used to determine if a project may cause a NAAQS violation. Project that pass worst-case screening analysis would not require a detailed analysis. This report summarizes the methods used for establishing a computer CO screening model (Illinois CO Screen for INtersection Modeling, COSIM) that can be used to determine when a detailed CO analysis is needed for highway projects in Illinois, for the Illinois Department of Transportation. This report also evaluates USEPA's model, CAL3QHC, to determine CO levels at three intersections in Illinois.

NTIS

Carbon Monoxide; Planning; Air Pollution; Computerized Simulation; Highways; Environment Models; Qualitative Analysis; Pollution Monitoring

20000070839 Minnesota Pollution Control Agency, Saint Paul, MN USA

Guide to Noise Control in Minnesota: Acoustical Properties, Measurement, Analysis, Regulation

Timerson, B. J.; Mar. 1999; 34p; In English

Report No.(s): PB2000-103974; No Copyright; Avail: National Technical Information Service (NTIS)

Contents include the following: Introduction (Wave Motion, Decibel Levels of Common Noise Sources); Using decibels (Distance Attenuation Estimations, Addition and Subtraction of Decibel Levels, Background Noise Correction); Human perception of sound (Perceived Change in Decibel Levels, Weighting Networks); Measurement procedures (Errors Caused by Reflecting Objects, NTP-1 Measurement Procedures, NTP-2 Test Procedure); Rules of thumb; Regulatory agencies; Noise rules and statutes (Minnesota Noise Pollution Control Rules , Minnesota Motor Vehicle Noise Limits, Minnesota Motorboat Noise Limits, Minnesota Snowmobile Noise Limits.)

NTIS

Acoustic Measurement; Noise Reduction; Minnesota; Law (Jurisprudence)

20000072434 NASA Goddard Space Flight Center, Greenbelt, MD USA

Arctic Climate and Atmospheric Planetary Waves

Cavalieri, D. J., NASA Goddard Space Flight Center, USA; Haekkinen, S., NASA Goddard Space Flight Center, USA; [2000]; 13p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Analysis of a fifty-year record (1946-1995) of monthly-averaged sea level pressure data provides a link between the phases of planetary-scale sea level pressure waves and Arctic Ocean and ice variability. Results of this analysis show: (1) a breakdown of the dominant wave I pattern in the late 1960's, (2) shifts in the mean phase of waves 1 and 2 since this breakdown, (3) an eastward shift in the phases of both waves 1 and 2 during the years of simulated cyclonic Arctic Ocean circulation relative to their phases during the years of anticyclonic circulation, (4) a strong decadal variability of wave phase associated with simulated Arctic Ocean circulation changes. Finally, the Arctic atmospheric circulation patterns that emerge when waves 1 and 2 are in their extreme eastern and western positions suggest an alternative approach to determine significant forcing patterns of sea ice and high-latitude variability.

Author

Arctic Regions; Atmospheric Circulation; Climate; Planetary Waves; Variability; Sea Level

20000072439 NASA Goddard Space Flight Center, Greenbelt, MD USA

Significant Features Found in Simulated Tropical Climates Using a Cloud Resolving Model

Shie, C.–L., NASA Goddard Space Flight Center, USA; Tao, W.–K., NASA Goddard Space Flight Center, USA; Simpson, J., NASA Goddard Space Flight Center, USA; Sui, C.–H., NASA Goddard Space Flight Center, USA; [2000]; 4p; In English; ICCP Conference, 14-18 Aug. 2000, Reno, NV, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Cloud resolving model (CRM) has widely been used in recent years for simulations involving studies of radiative-convective systems and their role in determining the tropical regional climate. The growing popularity of CRMs usage can be credited for their inclusion of crucial and realistic features such like explicit cloud-scale dynamics, sophisticated microphysical processes, and explicit radiative-convective interaction. For example, by using a two-dimensional cloud model with radiative-convective inter-action process, found a QBO-like (quasibiennial oscillation) oscillation of mean zonal wind that affected the convective system. Accordingly, the model-generated rain band corresponding to convective activity propagated in the direction of the low-level zonal mean winds; however, the precipitation became "localized" (limited within a small portion of the domain) as zonal mean winds were removed. Two other CRM simulations by S94 and Grabowski et al. (1996, hereafter G96), respectively that produced distinctive quasi-equilibrium ("climate") states on both tropical water and energy, i.e., a cold/dry state in S94 and a warm/wet state in G96, have later been investigated by T99. They found that the pattern of the imposed large-scale horizontal wind and the magni-tude of the imposed surface fluxes were the two crucial mechanisms in determining the tropical climate states. The warm/wet climate was found associated with prescribed strong surface winds, or with maintained strong vertical wind shears that well-orga-nized convective systems prevailed. On the other hand, the cold/dry climate was produced due to imposed weak surface winds and weak wind shears throughout a vertically mixing process by convection. In this study, considered as a sequel of T99, the model simulations to be presented are generally similar to those of T99 (where a detailed model setup can be found), except for a more detailed discussion along with few more simulated experiments. There are twelve major experiments chosen for presentations that are introduced in section two. Several significant feature analyses regarding the rainfall properties, CAPE (Convective Avail-able Potential Energy), cloud-scale eddies, the stability issue, the convective system propagation, relative humidity, and the effect on the quasi-equilibrium state by the imposed constant. radiation or constant surface fluxes, and etc. will be presented in the meeting. However, only three of the subjects are discussed in section three. A brief summary is concluded in the end section.
Author

Simulation; Tropical Regions; Climate; Atmospheric Models; Two Dimensional Models; Convection

20000072490 Michigan Univ., Coll. of Engineering, Ann Arbor, MI USA

Airborne Measurements of Nitric Oxide, Nitrogen Dioxide, Ozone, and Total Reactive Nitrogen During the NASA Global Tropospheric Experiment *Final Report, 1 Oct. 1995 - 28 Feb. 2000*

Carroll, Mary Anne, Michigan Univ., USA; [2000]; 44p; In English
Contract(s)/Grant(s): NAG1-1755; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Fabrication of the University of Michigan Multichannel Chemiluminescence Instrument (UMMCI) was completed in early 1996 and the instrument participated in test flights on the NASA P3B at Wallops Island prior to integration and deployment for the PEM- Tropics A Mission. The UMMCI consists of 4 channels for simultaneous measurements of ozone and NO with the option for measurements of NO2 and NOy (total reactive nitrogen) when converters are placed upstream of the NO channels. Each NO channel consists of a zeroing volume and reaction vessel, while the ozone channel consists of an ozone catalyst (or scrubber) trap that is not in line with the reaction vessel. The detectors in all for channels are Hamamatsu photomultiplier tubes, which are followed by pulse amplifier discriminators on the NO channels and an electrometer on the ozone channel. Schematics of the Detector Module and NOx/03 Probe Insert and Diagrams of the Control and Data System, the Power and Ground System, the Gas Flow System, and the Calibration System Flow are attached. Intercomparisons were conducted with G. Gregory, NASA/Langley, during the test flights (following prior calibration of the ozone generator/calibrators at the Wallops Long-Path Absorption facility). Initial test results appeared to be reasonable, and instrument characterization studies proceeded for the ozone channel and the 3 NO channels until deployment for integration for the PEM-Tropics Mission. Ozone data was obtained for Flights #4, and 6-2 1, and finalized data was submitted to the PEM-Tropics Data Archive and to the Science Team during the April 1997 Data Workshop. Although it initially appeared that the instrument sensitivity varied, subsequent tests showed that this was the fault of a leak in the ozone calibrator. In fact; the instrument sensitivity has not been observed to vary in a large number of tests over the years since the PEM-Tropics mission. We have, therefore, a very high degree of confidence in the O3 data that we submitted. NO data was obtained for all flights except the mission out of Christmas Island and the subsequent return to Hawaii, during which time the NO channels were contaminated with back-flushing pure NO from the O3 channel. The NO channels were found to suffer from a varying artifact (7 - 22 pptv) which made the instrument's results unreliable for the marine boundary layer portions of the missions (where conditions were extremely clean with NO typically is less than 2 pptv and O3 only 8 ppbv). Nonetheless, the NO values were an upper limit and were quite useful in identifying pollution layers and outflow from the Latin American Continent. NO data

was submitted to the archive for all flights during which data was obtained. Ozone data from the P3B was among the results presented in several peer-reviewed publications. Notably, the ozone data supported the first published finding of evidence for the occurrence of aerosol nucleation in the marine boundary layer. As well, the ozone data was utilized in a treatment of the wave-number spectra of winds, temperature and trace gases and to demonstrate the occurrence of layering as observed by the P3B during PEM-Tropics A . O3 and NO data were used in an assessment of the impact of southern hemispheric biomass burning, and in the role of NOx and O3 in HOx photochemistry during the PEM Tropics A mission. These data, along with other species measured during PEM-Tropics A, have also been employed in the generation of climatologies for tropospheric ozone and its precursors by the PI's research group.

Derived from text

Nitric Oxide; Nitrogen Dioxide; Nitrogen Oxides; Ozone; Tropical Regions; Troposphere

20000073225 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

A Combined Length-of-Day Series Spanning 1832-1997

Gross, Richard S., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Earth's rotation is not constant but exhibits minute changes on all observable time scales ranging from subdaily to secular. This rich spectrum of observed Earth rotation changes reflects the rich variety of astronomical and geophysical phenomena that are causing the Earth's rotation to change, including, but not limited to, ocean and solid body tides, atmospheric wind and pressure changes, oceanic current and sea level height changes, post-glacial rebound, and torques acting at the core-mantle boundary. In particular, the decadal-scale variations of the Earth's rotation are thought to be largely caused by interactions between the Earth's outer core and mantle. Comparing the inferred Earth rotation variations caused by the various core-mantle interactions to observed variations requires Earth rotation observations spanning decades, if not centuries. During the past century many different techniques have been used to observe the Earth's rotation. by combining the individual Earth rotation series determined by each of these techniques, a series of the Earth's rotation can be obtained that is based upon independent measurements spanning the greatest possible time interval. In this study, independent observations of the Earth's rotation are combined to generate a length-of-day series spanning 1832-1997. The observations combined include lunar occultation measurements spanning 1832-1955, optical astrometric measurements spanning 1956-1982, lunar laser ranging measurements spanning 1970-1997, and very long baseline interferometric measurements spanning 1978-1998. These series are combined using a Kalman filter developed at JPL for just this purpose. The resulting combined length-of-day series will be presented and compared with other available length-of-day series of similar duration.

Author

Earth Rotation; Atmospheric Circulation; Geophysics; Periodic Variations; Core-Mantle Boundary; Astronomy

20000073719 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

A Study of Stratospheric Aerosols and Their Effect on Inorganic Chlorine Partitioning Using Balloon, In Situ, and Satellite Observations

Osterman, G. B., Jet Propulsion Lab., California Inst. of Tech., USA; Salawitch, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Sen, B., Jet Propulsion Lab., California Inst. of Tech., USA; Toon, G. C., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Heterogeneous reactions on the surface of aerosols lead to a decrease in the concentration of nitrogen radicals and an increase in the concentration of chlorine and hydrogen radical species. As a consequence, enhanced sulfate aerosol levels in the lower stratosphere resulting from volcanic eruptions lead to lower concentrations of ozone due to more rapid loss by chlorine and hydrogen radicals. This study focuses on continuing the effort to quantify the effect of sulfate aerosols on the partitioning of inorganic chlorine species at midlatitudes. The study begins with an examination of balloon-borne measurements of key chlorine species obtained by the JPL MkIV interferometer for different aerosol loading conditions. A detailed comparison of the response of HCl to variations in aerosol surface area observed by MkIV, ER-2 instruments, HALOE, and ATMOS is carried out by examining HCl vs CH4 correlation diagrams, since CH4 is the only tracer measured on each platform. Finally, the consistency between theory and observed changes in ClO and HCl due to variations in aerosol surface area is examined.

Author

Stratosphere; Aerosols; Inorganic Compounds; Chlorine; Hydrogen; Nitrogen; Radicals

20000073804 Risoe National Lab., Wind Energy and Atmospheric Physics Dept., Roskilde, Denmark

Dense gas dispersion in the atmosphere

Nielsen, M.; Sep. 30, 1998; 279p; In English

Report No.(s): DE99-717254; RISO-R-1030(EN); ISBN 87-550-2362-2; No Copyright; Avail: Department of Energy Information Bridge

Dense gas dispersion is characterized by buoyancy induced gravity currents and reduction of the vertical mixing. The temperature deficit is moderated by the heat flux from the ground, and this convection is an additional source of turbulence which affects the mixing. A simple model as the soil heat flux is used to estimate the ability of the ground to sustain the heat flux during release. The initial enthalpy, release rate, initial entrainment and momentum are discussed for generic source types and the interaction with obstacles is considered. In the MTH project/BA experiments, source with and without momentum were applied. The continuously released propane gas passed a two-dimensional removable obstacle perpendicular to the wind direction. Ground-level gas concentrations and vertical profiles of concentration, temperature, wind speed and turbulence were measured in front of and behind the obstacle. Ultrasonic anemometers providing fast velocity and concentration signals were mounted at three levels on the masts. The observed turbulence was influenced by the stability and the initial momentum of the jet releases. Additional information were taken from the 'Dessert tortoise' ammonia jet releases, from the 'Fladis' experiment with transition from dense to passive dispersion, and from the 'Thorney Island' continuous releases of isothermal freon mixtures. The heat flux measurements are compared to an estimate by analogy with surface layer theory.
NTIS
Gas Density; Gas Flow; Dispersions; Liquefied Gases

46
GEOPHYSICS

Includes earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see 47 Meteorology and Climatology; and 93 Space Radiation.

20000068455 NASA Goddard Space Flight Center, Greenbelt, MD USA
Estimating the Crustal Power Spectrum From Vector Magsat Data: Crustal Power Spectrum

Lowe, David A. J., Scripps Institution of Oceanography, USA; Parker, Robert L., Scripps Institution of Oceanography, USA; Purucker, Michael E., NASA Goddard Space Flight Center, USA; Constable, Catherine G., Scripps Institution of Oceanography, USA; [2000]; 34p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Earth's magnetic field can be subdivided into core and crustal components and we seek to characterize the crustal part through its spatial power spectrum $R(sub l)$. We process vector Magsat data to isolate the crustal field and then invert power spectral densities of flight-local components along-track for $R(sub l)$ following O'Brien et al. [1999]. Our model (LPPC) is accurate up to approximately degree 45 (lambda=900 km) - this is the resolution limit of our data and suggests that global crustal anomaly maps constructed from vector Magsat data should not contain features with wavelengths less than 900 km. We find continental power spectra to be greater than oceanic ones and attribute this to the relative thicknesses of continental and oceanic crust.
Author
Crusts; Estimating; Power Spectra; Magnetic Fields; Earth Crust; Geomagnetism

20000068482 Texas Univ. at Dallas, William B. Hanson Center for Space Sciences, Richardson, TX USA
Longitudinal and Seasonal Variations in Nighttime Plasma Temperatures in the Equatorial Topside Ionosphere During Solar Maximum

Venkatraman, Sarita, Texas Univ. at Dallas, USA; Heelis, Rod, Texas Univ. at Dallas, USA; Journal of Geophysical Research; Feb. 01, 1999; ISSN 0148-0227; Volume 104, No. A2, pp. 2603-2611; In English
Contract(s)/Grant(s): NAG5-4465; NSF ATM-96-15064
Report No.(s): Paper 1998JA900109; Copyright; Avail: Issuing Activity

Latitude profiles of the ion and electron temperatures and total ion concentration across the equatorial region near 800 km altitude are routinely obtained from Defense Meteorological Satellite Program (DMSP) spacecraft. We have examined these profiles at 2100 hours local time to discover the influences of field-aligned plasma transport induced by F region neutral winds. Such dependencies are readily seen by contrasting observations at different seasons and different longitudes distinguished by different magnetic declinations. These data show strong evidence for adiabatic heating produced by interhemispheric plasma transport. This heating manifests itself as a local temperature maximum that appears in the winter hemisphere during the solstices and is generally absent during equinox. A longitudinal variation in the appearance of this maximum is consistent with the roles of meridional and zonal winds in modulating the field-aligned plasma velocities. The data also show a local temperature minimum

near the dip equator. However, it is not so easy to attribute this minimum to adiabatic cooling since transport of plasma from below and the latitude variation in the flux tube content may also produce such a minimum.

Author

Annual Variations; Equatorial Regions; Heating; Latitude; Longitude; Ion Temperature; Ion Concentration; Plasma Temperature

20000069791 Lunar and Planetary Inst., Houston, TX USA

Sudbury Structure 1997: A Persistent Enigma

Dressler, B. O., Lunar and Planetary Inst., USA; Sharpton, V. L., Lunar and Planetary Inst., USA; 1999; 6p; In English; 2nd; Large Meteorite Impacts and Planetary Evolution, 1999, Boulder, CO, USA

Report No.(s): LPI-Contrib-935; Special-Paper-339; Copyright; Avail: Issuing Activity

It took almost 30 years for the origin of the Sudbury Structure as the result of asteroid or comet impact to gain wide acceptance in the geosciences community. Most field and laboratory observations can be reconciled with an impact origin. However, there is disagreement among proponents of the impact hypothesis as to the interpretations of several field observations and laboratory results. and there is no agreement on such issues as the size of the structure; the origin of the Sudbury Igneous Complex, including the Sublayer and mineral deposits; the origin and distribution of Sudbury pseudotachylites (Sudbury Breccia); the provenance of carbon in the rocks filling the Sudbury Basin; the presence or absence of fullerenes in these basin rocks; and the meaning of high-precision U-Pb geochronological dates of the Sudbury Igneous Complex.

Author

Cometary Collisions; Asteroids; Geophysics; Geochronology; Fullerenes

20000069798 Alabama Univ., Dept. of Civil and Environmental Engineering, Huntsville, AL USA

Shear Band Formation in Plane Strain Experiments of Sand

Alshibli, Khalid A., Alabama Univ., USA; Sture, Stein, Colorado Univ., USA; Journal of Geotechnical and Geoenvironmental Engineering; June 2000; ISSN 1090-0241; Volume 126, No. 6, pp. 495-503; In English

Contract(s)/Grant(s): NAS8-38779

Report No.(s): Paper-21167; Copyright; Avail: Issuing Activity

A series of biaxial (plane strain) experiments were conducted on three sands under low (15 kPa) and high (100 kPa) confining pressure conditions to investigate the effects of specimen density, confining pressure, and sand grain size and shape on the constitutive and stability behavior of granular materials. The three sands used in the experiments were fine-, medium-, and coarse-grained uniform silica sands with rounded, subangular, and angular grains, respectively. Specimen deformation was readily monitored and analyzed with the help of a grid pattern imprinted on the latex membrane. The overall stress-strain behavior is strongly dependent on the specimen density, confining pressure, sand grain texture, and the resulting failure mode(s). That became evident in different degrees of softening responses at various axial strains. The relationship between the constitutive behavior and the specimens' modes of instability is presented. The failure in all specimens was characterized by two distinct and opposite shear bands. It was found that the measured dilatancy angles increase as the sand grains' angularities and sizes increase. The measured shear band inclination angles are also presented and compared with classical Coulomb and Roscoe solutions.

Author

Plane Strain; Stress-Strain Relationships; Axial Strain; Stress Ratio; Sands; Silicon Dioxide

20000070323 Howard Univ., Dept. of Physics and Astronomy, Washington, DC USA

ARGOS/EUVIP Data Development and Utilization *Annual Report, 15 May-Oct 1999*

Reynolds, Mark A., Howard Univ., USA; Oct. 22, 1999; 4p; In English

Contract(s)/Grant(s): N00014-99-1-0621

Report No.(s): AD-A377705; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

The initial work performed under the "Advanced Research and Global Observation/Extreme Ultraviolet Imaging Photometer (ARGOS/EUVIP) Data Development and Utilization" grant is detailed in this annual report. Theoretical work on the coupling between the plasmasphere and the ionosphere was initiated. Analysis of the data from the EUVIP instrument was begun.

DTIC

Imaging Techniques; Ultraviolet Photometry; Plasmasphere; Remote Sensing; Earth Ionosphere

20000070392 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Analysis of Small-Scale Atmospheric Gravity Waves Using UARS MLS Radiance Measurements

Wu, Dong L., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 38; In English;

Gravity waves play an important role in determining atmospheric circulation and small-scale mixing. Upper Atmosphere Research Satellite (UARS) Microwave Limb Sounder (MLS) 63-GHz radiances can be used to calculate small-scale wave variances at 30-80 km altitudes. The major results from this new data set are summarized in the following: (1) MLS radiance fluctuations are contributed mostly by gravity waves of small (about 100 km) horizontal and large (>10 km) vertical scales. (2) MLS observations show that variance enhancements are strongly correlated with the stratospheric polar vortices, tropospheric deep convection zones, and surface topography. (3) As expected for gravity wave propagation, the normalized wave variances grow exponentially with height in the stratosphere but saturate in the mesosphere. (4) The long-term variations of the wave variance are dominated by an annual cycle in the stratosphere and a semiannual cycle in the mesosphere. (5) Separate analyses of the ascending and descending measurements show that the variances are sensitive to wave propagation directions. The subtropical variances, which are associated with deep convection, are likely caused by the gravity waves that propagate upward and eastward in the westward background wind. Additional information contained in the original.
Author
Atmospheric Circulation; Gravity Waves; Stratosphere; Wave Propagation; Wind (Meteorology)

20000070462 NASA Goddard Space Flight Center, Greenbelt, MD USA
On Geomagnetism and Paleomagnetism I
Voorhies, Coerte V., NASA Goddard Space Flight Center, USA; [2000]; 26p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A partial description of Earth's broad scale, core-source magnetic field has been developed and tested three ways. The description features an expected, or mean, spatial magnetic power spectrum that is approximately inversely proportional to horizontal wavenumber atop Earth's core. This multipole spectrum describes a magnetic energy range; it is not steep enough for Gubbins' magnetic dissipation range. Temporal variations of core multipole powers about mean values are to be expected and are described statistically, via trial probability distribution functions, instead of deterministically, via trial solution of closed transport equations. The distributions considered here are closed and neither require nor prohibit magnetic isotropy. The description is therefore applicable to, and tested against, both dipole and low degree non-dipole fields. In Part 1, a physical basis for an expectation spectrum is developed and checked. The description is then combined with main field models of twentieth century satellite and surface geomagnetic field measurements to make testable predictions of the radius of Earth's core. The predicted core radius is 0.7% above the 3480 km seismological value. Partial descriptions of other planetary dipole fields are noted.
Author
Paleomagnetism; Geomagnetism; Magnetic Fields; Models; Earth (Planet); Planetary Magnetic Fields

20000070668 Institut Francais du Petrole, Rueil-Malmaison, France
Effects of a stress field on the evolution of the single-phase permeability of a sandstone
Ferfera, F.; Sep. 15, 1997; 187p; In French; In English
Report No.(s): DE99-713698; IFP-44082; No Copyright; Avail: Department of Energy Information Bridge

The permeability evolution of a reservoir rock may be attributed to three successive phenomena: closure of the existing fissures, elastic deformation of the pore space and finally, non-reversible damage to the pore walls. Simultaneous measurements of strains and single-phase permeability were performed in a Vosges sandstone. Several loadings paths have been investigated together with several pore pressure and confining pressure levels. Results are analyzed in order to show the influence of the effective means stress (p') and the deviatoric stress (q). It is shown that a criterion can be defined in the (p'-q) plot for the permeability evolution. Inside the domain defined by the criterion, the permeability change is nil or small whatever the loading path. Outside the domain, the permeability steadily decreases and may vary strongly. It is also shown that the permeability reduction rate is controlled by stress path independently of the stress level. The most deviatoric stress path induced the lowest reduction rate; it is thus possible to derive the permeability changes if the stress path and the deviatoric stress value are known
NTIS
Permeability; Sandstones; Stress Distribution; Porous Materials; Petrology

20000070748 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Acoustical Scattering From Atmospheric Turbulence
Auvermann, Harry J.; Goedecke, George H.; Dec. 1992; 14p; In English, 1-3 Dec. 1992, Fort Bliss, TX, USA
Report No.(s): AD-A377885; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The objective of the ASL research effort in acoustic propagation is to provide the Army with a multi-stream model for investigating acoustic detection systems. The first step in developing this model is to account for turbulent scattering. Five elements are

necessary to accomplish this step: (1) model the turbulent region as a collection of vortices with a distribution of characteristic sizes/velocities; (2) characterize each vortex (turble) as a known (or assumed) velocity distribution in three space; (3) solve the fluid equations to determine the scattering from each turble; (4) sum the contributions to the scattered sound pressure level at the detector location of all turbles accounting for the propagation characteristics of the atmospheric medium; and (5) incorporate the algorithms devised above into existing (or appropriately modified) propagation models. Progress in these five areas will be reported.
DTIC
Acoustic Propagation; Acoustic Scattering; Atmospheric Turbulence; Atmospheric Models

20000070846 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Breadth of Scientific Activities and Network Station Specifications in the IGS
Moore, A. W., Jet Propulsion Lab., California Inst. of Tech., USA; Springer, T. A., Bern Univ., Switzerland; Reigber, Ch., Geo-ForschungsZentrum, Germany; [1999]; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation provides a brief overview of the scientific activities of the International GPS Service (IGS). This was an approved activity of the International Association of Geodesy (IAG) with official start of service on 1 Jan 1994. The mission of the IGS is "To provide a service to support geodetic and geophysical research activities, through GPS data and data products." The presentation explains the concept of the IGS working group, and pilot projects, and reviews the current working groups and pilot projects.
Author
Global Positioning System; Organizations; International Cooperation; Ground Stations

20000070858 Scripps Institution of Oceanography, La Jolla, CA USA
Geodetic Observations of Interseismic Strain Segmentation at the Sumatra Subduction Zone
Prawirodirdjo, L., Scripps Institution of Oceanography, USA; Bock, Y., Scripps Institution of Oceanography, USA; McCaffrey, R., Rensselaer Polytechnic Inst., USA; Genrich, J., Scripps Institution of Oceanography, USA; Calais, E., Scripps Institution of Oceanography, USA; Puntodewo, S. S. O., Rensselaer Polytechnic Inst., USA; Subarya, C., Rensselaer Polytechnic Inst., USA; Rais, J., Rensselaer Polytechnic Inst., USA; Zwick, P., Rensselaer Polytechnic Inst., USA; Fauzi, Rensselaer Polytechnic Inst., USA; Geophysical Research Letters; Nov. 01, 1997; ISSN 0094-8534; Volume 24, No. 21, pp. 2601-2604; In English; Original contains color illustrations
Report No.(s): Paper-97GL52691; Copyright; Avail: Issuing Activity

Deformation above the Sumatra subduction zone, revealed by Global Positioning System (GPS) geodetic surveys, shows nearly complete coupling of the forearc to the subducting plate south of 0.5 deg S and half as much to north. The abrupt change in plate coupling coincides with the boundary between the rupture zones of the 1833 and 1861 (Mw greater than 8) thrust earthquakes. The rupture boundary appears as an abrupt change in strain accumulation well into the interseismic cycle, suggesting that seismic segmentation is controlled by properties of the plate interface that persist occupied through more than one earthquake cycle. Structural evidence indicates that differences in basal shear stress may be related to elevated pore pressure in the north.
Author
Geodetic Surveys; Deformation; Global Positioning System; Earthquakes; Seismology; Shear Stress

20000072430 Washington Univ., Applied Physics Lab., Seattle, WA USA
Hyperspectral Estimation of Aerosol Parameters and Water-Leaving Radiance in Dusty Atmospheres Using Vertical Profiling Information *Final Report, 15 May 1998-30 Sep 1999*
Winebrenner, Dale P.; Sylvester, John; May 12, 2000; 6p; In English
Contract(s)/Grant(s): N00014-98-1-0675
Report No.(s): AD-A377665; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The specific objectives of this project were: (1) to understand quantitatively how the accuracy of dust parameter and ocean color estimates from hyperspectral data depend on knowledge of vertical aerosol distributions and dust particle absorption; (2) to develop improved methods for estimating dust aerosol properties and water-leaving-radiance (WLR) from hyperspectral and limited vertical profile data, including data from the newest generations of NASA (SeaWIFS, MODIS, MISR, and spaceborne lidar) and DoD (COTS/NEMO) sensors; and (3) to demonstrate the initial use of such methods in investigation of dust outbreaks over littoral seas.
DTIC
Light Scattering; Radiative Transfer; Aerosols; Atmospheric Optics; Radiance

20000073213 NASA Goddard Space Flight Center, Greenbelt, MD USA

Ion Layer Separation and Equilibrium Zonal Winds in Midlatitude Sporadic E

Earle, G. D., Texas Univ. at Dallas, USA; Kane, T. J., Pennsylvania State Univ., USA; Pfaff, R. F., NASA Goddard Space Flight Center, USA; Bounds, S. R., NASA Goddard Space Flight Center, USA; Geophysical Research Letters; Feb. 15, 2000; ISSN 0094-8276; Volume 27, No. 4, pp. 461-464; In English

Contract(s)/Grant(s): NAG5-5086; NAG5-5076; NAG5-5035

Report No.(s): Paper 1999GL900572; Copyright; Avail: Issuing Activity

In-situ observations of a moderately strong mid-latitude sporadic-E layer show a separation in altitude between distinct sublayers composed of Fe(+), Mg(+), and NO(+). From these observations it is possible to estimate the zonal wind field consistent with diffusive equilibrium near the altitude of the layer. The amplitude of the zonal wind necessary to sustain the layer against diffusive effects is less than 10 meters per second, and the vertical wavelength is less than 10 km.

Author

Sporadic E Layer; Temperate Regions; Wind (Meteorology); Equilibrium; Metal Ions; Zonal Flow (Meteorology)

20000073226 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Performance of a 2.5 THz Receiver Front-End for Spaceborne Applications

Gaidis, Michael C., Jet Propulsion Lab., California Inst. of Tech., USA; Pickett, H. M., Jet Propulsion Lab., California Inst. of Tech., USA; Siegel, P. H., Jet Propulsion Lab., California Inst. of Tech., USA; Smith, C. D., Jet Propulsion Lab., California Inst. of Tech., USA; Smith, R. P., Jet Propulsion Lab., California Inst. of Tech., USA; Martin, S. C., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; Optical Science, Engineering and Instrumentation, 18-23 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The OH radical plays a significant role in a great many of the known ozone destruction cycles, and has become the focus of an important radiometer development effort for NASA's Earth Observing System Chem I satellite, which will monitor and study many tropospheric and stratospheric gases and is scheduled for launch in 2002. Here we describe the design, fabrication, and testing of a receiver front end used to detect the OH signals at 2.5 THz. This is to be the first Terahertz heterodyne receiver to be flown in space. The challenges of producing the necessary high-performance mixers are numerous, but for this application, there is the added challenge of designing a robust receiver which can withstand the environmental extremes of a rocket launch and five years in space. The receiver front-end consists of the following components: a four-port dual-polarization diplexer, off-axis elliptical feed mirrors, mixers for horizontal and vertical polarization, support structures allowing simple and rugged alignment, low noise IF amplification from 7.7 to 21.1 GHz, and mixer DC bias circuitry. The front-end design, alignment, and operation will be covered in depth, followed by a discussion of the most recent results in receiver noise and dual-mode horn beam patterns. JPL MOMED mixers are employed, and have resulted in receiver noise temperatures of 14,500 K, DSB with LO frequency 2.522 GHz and IF of 12.8 GHz. Horn beam patterns correspond well with theory, with no significant sidelobes above the -25 dB level. Considering the high-quality beam of this receiver, these results are competitive with the best reported in the literature.

Author

Receivers; Beams (Radiation); Frequencies; Hydroxyl Radicals; Radiation Distribution; Earth Observing System (EOS)

20000073227 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Rotational and Gravitational Effect of Earthquakes

Gross, Richard, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The static displacement field generated by an earthquake has the effect of rearranging the Earth's mass distribution and will consequently cause the Earth's rotation and gravitational field to change. Although the coseismic effect of earthquakes on the Earth's rotation and gravitational field have been modeled in the past, no unambiguous observations of this effect have yet been made. However, the Gravity Recovery and Climate Experiment (GRACE) satellite, which is scheduled to be launched in 2001, will measure time variations of the Earth's gravitational field to high degree and order with unprecedented accuracy. In this presentation, the modeled coseismic effect of earthquakes upon the Earth's gravitational field to degree and order 100 will be computed and compared to the expected accuracy of the GRACE measurements. In addition, the modeled second degree changes, corresponding to changes in the Earth's rotation, will be compared to length-of-day and polar motion excitation observations.

Author

Gravitational Effects; Earthquakes; Gravitational Fields; Polar Wandering (Geology); Seismology

Scripps Institution of Oceanography, La Jolla, CA USA

A Geodetic Study of Sumatra and the Indonesian Region: Kinematics and Crustal Deformation from GPS and Triangulation

Prawirodirdjo, Linette M., Scripps Institution of Oceanography, USA; 2000; 170p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAGW-2641; NSF EAR-88-17067; NSF EAR-90-04376; Copyright; Avail: Issuing Activity

Indonesia is a tectonically complex region located where the Eurasia, Australia, Pacific, and Philippine Sea plates converge. This dissertation presents the analysis of geodetic GPS data collected in Indonesia from 1989 to 1994 and historical triangulation data collected in Sumatra in the late 1800s and early 1900s. The GPS data yield a horizontal velocity field, precise to within 1-2 cm/yr, referenced to a global frame. The velocity field in Indonesia shows that the regional tectonics can be described as several rigid blocks interacting in a convergent setting. Rotation parameters for these blocks are estimated from the horizontal velocities, and block interactions are discussed in connection with tectonic features and recent seismicity. An important result of this analysis, the Sunda Shelf block appears to be stationary relative to the Eurasia plate. The Sumatra velocity field shows NW-SE segmentation of strain accumulation on the forearc, suggesting that south of the equator the Sumatra subduction zone is fully locked, while to the north it is less than 50% coupled. The abrupt change in plate coupling coincides with the boundary separating rupture zones of the 1833 and 1861 (M greater than 8) subduction earthquakes, suggesting that seismic segmentation is controlled by properties of the plate interface that persist through more than one earthquake cycle. Analysis combining the Sumatra GPS data with triangulation measurements reveals a detailed slip history along the Surnatran Fault. The long-term (1883-1993) strains show right-lateral shear, with rates similar to 1989-1993, GPS measured, strain rates. The arc-parallel components of the combined velocity field are consistent with slip rates inferred from GPS data, ranging from 23 to 24 mm/yr between 1.0 S and 1.3 N. Here the Sumatran Fault is characterized by deep locking depths (approximately 20 km), and the occurrence of large (M (sub w) approximately 7) earthquakes. Coseismic deformation due to the 1892 and 1926 earthquakes, estimated from triangulation measurements, indicate that the main shocks were significantly larger than previously thought. The 1892 earthquake probably had a magnitude of M (sub w) approximately 7.6, while the 1926 events were probably M (sub w) approximately 7 instead of the previously reported M (sub w) approximately 6.

Author

Crustal Fractures; Geodesy; Global Positioning System; Indonesia; Kinematics; Triangulation; Seismology

Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Modeling Stratospheric Constituents: Reactive Species That Regulate Ozone

Salawitch, Ross J., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Photochemical loss of stratospheric ozone occurs primarily by catalytic cycles whose rates are limited by the concentration of OH, HO2, NO2, ClO, and/or BrO as well as the concentration of either atomic oxygen or of ozone itself. Once the concentrations of these gases are established, the photochemical loss rate of O3 depends on the rate coefficient of only a handful of key reactions. We have developed a method for testing our understanding of stratospheric ozone photochemistry by comparing measured and modeled concentrations of reactive hydrogen, nitrogen, chlorine and bromine radicals using a photochemical steady state model constrained by observed concentrations of long-lived precursors (e.g., NO(y), Cl(y), Br(y), O3, H2O, CH4) and environmental parameters such as ozone column, reflectivity, and aerosol surface area. We will show based on analyses of observations obtained by aircraft, balloon, and satellite platforms during the POLARIS campaign that our overall understanding of the processes that regulate these radical species is very good. The most notable current discrepancies are the tendency to underestimate observed NO2 by 15 to 30% for air masses that experience near continuous solar illumination over a 24 hour period and the tendency to underestimate observed OH and H02 by about 10 to 20% during midday and by much larger amounts at high solar zenith angle (SZA is greater than 85). Possible resolutions to these discrepancies will be discussed. This study was carried out in close collaboration with many members of the POLARIS science team.

Author

Atmospheric Composition; Ozone; Photochemical Reactions; Solar Position; Stratosphere; Photochemical Oxidants; Atmospheric Chemistry

NASA Goddard Space Flight Center, Greenbelt, MD USA

Interannual Atmospheric Oscillations and Their Gravitational Effects

Chao, Benjamin F., NASA Goddard Space Flight Center, USA; Au, A. Y., Raytheon ITSS, USA; [2000]; 1p; In English; 24th, 25-29 Apr. 2000, Nice, France; Sponsored by European Geophysical Society, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

Past studies have examined the effects of the interannual atmospheric oscillations (IAO), or often called teleconnection patterns, on the Earth's rotation, such as El Nino/Southern Oscillation (ENSO), the quasi-biennial oscillation, and to a lesser extent the North Atlantic Oscillation (NAO). The present study focuses on IAO's effects on the gravitational field and geocenter; the purpose is to be able to identify and isolate the contributions of each prominent IAO in relation to the total contribution of the atmosphere, in terms of their magnitudes, their geographical patterns, and their interannual time history. We use the 40-year NCEP reanalysis of the monthly, global atmospheric surface pressure field as our basic data set. The method we apply to isolate the IAOs is the empirical orthogonal function (EOF) decomposition which is widely used in meteorological investigations. We do the EOF analysis first on IAOs' seasonal signals (by "collapsing" the 40-year series into 12 mean-months for each grid point) and obtain estimates for their respective contributions. Then we remove these seasonal signals from the data to focus on the (broad-band) interannual EOFs. We examine ENSO, NAO, North Pacific Oscillation, and other less prominent IAOs that can be identified from our data set, and compute their respective contributions to the variation of global gravitational field and geocenter motion. Finally, we compare the results with the available observational data, and discuss the implications w.r.t. the upcoming space missions such as GRACE.

Author

Gravitational Effects; Atmospheric Pressure; Oscillations; Earth Rotation; Gravitational Fields

20000073389 NASA Marshall Space Flight Center, Huntsville, AL USA

POLAR Observations of Topside Field-Aligned O+ Flows and Auroral Forms

Stevenson, B. A., Alabama Univ., USA; Horwitz, J. L., Alabama Univ., USA; Germany, G., Alabama Univ., USA; Moore, T. E., NASA Goddard Space Flight Center, USA; Giles, B. L., NASA Goddard Space Flight Center, USA; Craven, P. D., NASA Marshall Space Flight Center, USA; Chandler, M. O., NASA Marshall Space Flight Center, USA; Su, Y. J., Los Alamos National Lab., USA; Parks, G. K., Washington Univ., USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Measurements of thermal O (sup +) ion densities, field-aligned velocities, and fluxes from the Thermal Ion Dynamics Experiment (TIDE) on POLAR obtained near 5000 km altitude over the Southern hemisphere are compared with auroral images from the Ultra Violet Imager (UVI). We find upward O (sup +) flows in the cleft region, but subsonic O (sup +) downflows in the polar cap region. Also, the O (sup +) ion density follows a decreasing trend from the poleward side of the cusp region into the nightside aurora region. The magnitude of the downward O (sup +) parallel velocities increases from dayside to nightside across the polar cap boundary. The upflows tend to occur over or near auroral forms, while the downflows are seen in relatively dark regions, such as the polar cap. These results are consistent with a cleft ion fountain source for the polar cap O (sup +) ions. In the nightside polar cap, the results indicate a transition from downward to upflowing field-aligned O (sup +) ions near boundaries of bright auroral arcs.

Author

Auroras; Oxygen Ions; Ion Density (Concentration); Ionic Mobility; Polar Regions

20000073395 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Generation of Earthquake Ground Motion Considering Local Site Effects and Soil-Structure Interaction Analysis of Ancient Structures

Kim, J. K.; Lee, J.; Yang, T.; Cho, J.; Sep. 30, 1997; 75p; In Korean; In English

Report No.(s): DE99-727797; KAERI-CM-174/96; No Copyright; Avail: Department of Energy Information Bridge

In order to establish a correct correlation between them, mechanical characteristics of the ancient structures need to be investigated. Since sedimentary basins are preferred dwelling sites in ancient times, it is necessary to perform SSI analysis to derive correct correlation between the damage and ground motion intensity. Contents of Project are as follows: (1) Generation of stochastic earthquake ground motion considering source mechanism and site effects. (2) Analysis of seismic response of sedimentary basin. (3) Soil-structure interaction analysis of ancient structures (4) Investigation of dynamic response characteristics of ancient structure considering soil- structure interaction effects. A procedure is presented for generation of stochastic earthquake ground motion considering source mechanism and site effects. The simulation method proposed by Boore is used to generate the outcropping rock motion. The free field motion at the soil site is obtained by a convolution analysis. and for the study of wood structures, a nonlinear SDOF model is developed. The effects of soil-structure interaction on the behavior of the wood structures are found to be very minor. But the response can be significantly affected due to the intensity and frequency contents of the input motion.

Author(NTIS)

Earthquakes; Ground State; Vibration; Correlation; Dynamic Response; Earth Movements; Nonlinearity

Naval Postgraduate School, Monterey, CA USA

Performance Analysis of IRTOOL and Comparison to LWKD Marine Boundary Layer Program

Christou, Ioannis; Dec. 1999; 201p; In English

Report No.(s): AD-A374320; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This thesis evaluates the ability of the IRTOOL computer simulation program to predict mirages. Using identical input conditions taken from the MAPTIP experiment database, predicted Minimum Mirage Range (MMR) and Maximum Intervision Range (MIVR) from both the IRTOOL and IRBLEM models were extracted and compared with the measurements recorded in the database. by comparison of the algorithms it was found that discrepancies in IRTOOL mirage prediction could be ascribed to the input function for significant ocean wave height, which gave values much greater than measured or used in IRBLEM. For a significant wave height close to the measured value the IRTOOL predictions were in very close agreement with observation and with IRBLEM. IRTOOL predictions were in all cases within 2.7 km and in most cases within 1.3 km of the measurements for all ranges varying from about 7-26 km. The strong temperature gradient predicted by the model within a few meters of the water surface, uncertainties in the measured range, and the variation of 0.8 to 2 C in Air Sea Temperature Difference are sufficient to account for the observed deviations. Differences between the model predictions and some of the problems encountered are also discussed. DTIC

Computer Programs; Computerized Simulation; Images; Air Water Interactions; Atmospheric Boundary Layer; Infrared Imagery; Marine Meteorology; Ocean Surface

Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Remotely Operating a Fourier Transform Spectrometer for Atmospheric Remote Sensing

Blavier, J.–F., Jet Propulsion Lab., California Inst. of Tech., USA; Toon, G. C., Jet Propulsion Lab., California Inst. of Tech., USA; Sen, B., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 3p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

This paper describes how the MkIV instrument was adapted for remote operation from the Barcroft site, where the harsh winter conditions make access difficult. Some of the main technical challenges will be discussed including, (i) operation from solar panels and batteries, (ii) cooling the detectors with LN2, (iii) instrument control and monitoring over a cellular phone, and (iv) data storage, processing and analysis. Finally, MkIV spectra measured from Barcroft and compared with those measured from JPL to highlight the advantages of the higher altitude site.

Derived from text

Remote Control; Automatic Control; Fourier Transformation; Holographic Spectroscopy; Spectrometers; Spectroscopic Analysis; Spectrum Analysis; Remote Sensors

Texas Univ. at Dallas, William B. Hanson Center for Space Sciences, Richardson, TX USA

On Relationships Between Horizontal Velocity Structure and Thermal Ion Upwellings at High Latitudes

Kivanc, O., Texas Univ. at Dallas, USA; Heelis, R. A., Texas Univ. at Dallas, USA; Geophysical Research Letters; Jul. 01, 1999; ISSN 0094-8276; Volume 26, No. 13, pp. 1829-1832; In English

Contract(s)/Grant(s): NAG5-4485; NSF ATM-96-15064; Copyright; Avail: Issuing Activity

Recent studies indicate that the vertical velocity of F region ion upwellings cannot be explained by frictional heating in the horizontal plane alone but requires additional energization sources. Processes involving velocity shear have recently been put forward as alternate mechanisms that can provide the energization in regions of smaller convection speeds. Studies show that structured flows can also give rise to significant upwelling of ions by seeding plasma waves that can potentially cause ion heating while Joule heating is relatively small. We provide a statistical analysis of the Dynamics Explorer 2 vertical and horizontal ion drift measurements that show further evidence for the significance of plasma wave energization process in regions of varying levels of Joule heating.

Author

F Region; Velocity Distribution; Horizontal Distribution; Ionic Waves; Geophysics; Polar Regions; Upwelling Water; Thermal Analysis

Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Ground-Based Measurements of Stratospheric Composition from Mt. Barcroft, California

Toon, G. C., Jet Propulsion Lab., California Inst. of Tech., USA; Blavier, J.–F., Jet Propulsion Lab., California Inst. of Tech., USA; Sen, B., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The MkIV is an FTIR spectrometer designed and built at JPL in the 1980's for remote sensing the composition of the Earth's atmosphere by solar absorption spectrometry. Optically, MkIV is very similar to the JPL ATMOS instrument, which flew three times on the Space Shuttle. Both use double-passed configurations with a KBr beamsplitter and compensator, in order to cover the mid-infrared. The main advantage of the MkIV is that it uses two detectors in parallel, a HgCdTe photoconductor for the long wavelengths and an InSb photodiode for the short wavelengths, allowing the entire 650 to 5650/cm region to be measured simultaneously. At a 10 kHz sampling rate, each 130 cm OPD interferogram takes 3 minutes to acquire. This paper describes how the MkIV instrument was adapted for remote operation from the Barcroft site, where the harsh winter conditions make access difficult. Some of the main technical challenges will be discussed including, (i) operation from solar panels and batteries, (ii) cooling the detectors with LN2, (iii) instrument control and monitoring over a cellular phone, and (iv) data storage, processing and analysis. Finally, MkIV spectra measured from Barcroft are compared with those measured from JPL to highlight the advantages of the higher altitude site.

Author

Ground Based Control; Stratosphere; Atmospheric Composition; Infrared Spectrometers; Remote Sensing; Solar Spectrometers

20000074097 Alabama Univ., Dept. of Civil and Environmental Engineering, Huntsville, AL USA

Evaluation of Instability Phenomena in Sands: Plane Strain Versus Triaxial Conditions

Alshibli, Khalid A., Alabama Univ., USA; [2001]; 1p; In English; 15th; 15th International Conference on Soil Mechanics and Engineering, 27-31 Aug. 2001, Istanbul, Turkey

Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

Extensive research was carried out in the 1950s on theories of plasticity to extend the concepts developed for metals to materials that failed according to the Mohr-Coulomb criterion. The new ideas made it possible to merge the two distinct concepts (strength and deformation techniques) into one that relies on better understanding of plasticity and resulted in a rapid growth in the field of constitutive modeling of soil behavior. At the same time advanced experimental apparatuses and laboratory procedures were developed to calibrate the models. However, most laboratory experiments on granular materials are performed under Conventional Triaxial Conditions (CTC) for the purposes of evaluating constitutive behavior and stability properties, whereas most geotechnical field problems are closer to the Plane Strain (PS) condition. The triaxial tests performed in most laboratories comprise a simplification over in situ states and allow easier and robust experimentation. Most landslide problems, failure of soils beneath shallow and deep foundations, and failure of retaining structures, are cases that can generally be considered as plane strain. Strength and deformation characteristics of granular materials loaded in plane strain may be considerably different from those observed in CTC. Most studies on sands were limited to evaluating the constitutive behavior and in some cases extended to briefly describing the associated instability phenomena. This paper presents the results of a series of PS and CTC experiments performed on fine uniform silica sand known as F-75 Ottawa sand. Advanced analysis techniques were used to study the instability phenomena, which yielded very accurate measurements of shear bands occurrences and patterns. Destructive thin-sectioning technique along with monitoring the specimen surface deformation was used in the PS experiments and Computed Tomography (CT) was used to investigate the progress of primary and secondary shear bands in specimens subjected to CTC. Comparison between the two cases will be presented and discussed.

Author

Plane Strain; Sands; Stability; Triaxial Stresses; Mechanical Properties; Geotechnical Engineering

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification

20000068436 NASA Marshall Space Flight Center, Huntsville, AL USA

Entrainment of Upper Level Dry Air into Hurricane Earl

Guillory, Anthony R., NASA Marshall Space Flight Center, USA; Jedlovee, Gary J., NASA Marshall Space Flight Center, USA; Hood, Robbie E., NASA Marshall Space Flight Center, USA; Atkinson, Robert J., Lockheed Martin Corp., USA; LaFontaine, Frank J., Raytheon ITSS, USA; 24th Conference on Hurricanes and Tropical Meteorology and 10th Conference on Interaction of the Sea and Atmosphere; [2000], pp. 358-359; In English; 24th; 10th; Hurricanes and Tropical Meteorology, 29 May - 2 Jun. 2000, Fort Lauderdale, FL, Fort Lauderdale, FL, USA, USA; Sponsored by American Meteorological Society, USA

Contract(s)/Grant(s): RTOP 622-29-30; Copyright; Avail: Issuing Activity

Hurricane Earl developed from a tropical wave that moved into the Gulf of Mexico, which triggered abundant convection. On 1 Sept. 1998, the wave was upgraded directly to a tropical storm. Earl reached hurricane status the next morning. The system

moved erratically as it interacted with an upper level short wave trough rotating around a long wave trough to the northeast. The storm made landfall near 0600 UTC on 3 September near Panama City, FL. During August and September 1998, NASA conducted the Third Convection and Moisture Experiment (CAMEX-3). It focused on studying the intensity, track, and impacts at landfall of hurricanes. On the afternoon of 2 September 1998, the NASA ER2 high-altitude aircraft flying at 65,000 feet in tandem with the NASA DC-8 flying at 35,000 feet flew over and through, respectively, the eastern rainbands of Earl near the Florida Panhandle as the storm neared landfall in the region. Two approaches to studying Earl are undertaken here: first, an examination of the source and height of the dry air region using GOES-8 water vapor data and, second, a look into the impact of the dry air entrainment on the system using aircraft remote sensing data.

Derived from text

Air Flow; Drying; Entrainment; Hurricanes; Remote Sensing; Upper Atmosphere

20000068519 NASA Goddard Space Flight Center, Greenbelt, MD USA

Global Precipitation at One-Degree Daily Resolution From Multi-Satellite Observations

Huffman, George J., NASA Goddard Space Flight Center, USA; Adler, Robert F., NASA Goddard Space Flight Center, USA; Morrissey, Mark M., Oklahoma Univ., USA; Curtis, Scott, NASA Goddard Space Flight Center, USA; Joyce, Robert, National Centers for Environmental Prediction, USA; McGavock, Brad, Oklahoma Univ., USA; Susskind, Joel, NASA Goddard Space Flight Center, USA; [2000]; 27p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The One-Degree Daily (1DD) technique is described for producing globally complete daily estimates of precipitation on a 1 deg x 1 deg lat/long grid from currently available observational data. Where possible (40 deg N-40 deg S), the Threshold-Matched Precipitation Index (TMPI) provides precipitation estimates in which the 3-hourly infrared brightness temperatures (IR T(sub b)) are thresholded and all "cold" pixels are given a single precipitation rate. This approach is an adaptation of the Geostationary Operational Environmental Satellite (GOES) Precipitation Index (GPI), but for the TMPI the IR Tb threshold and conditional rain rate are set locally by month from Special Sensor Microwave/Imager (SSM/I)-based precipitation frequency and the Global Precipitation Climatology Project (GPCP) satellite-gauge (SG) combined monthly precipitation estimate, respectively. At higher latitudes the 1DD features a rescaled daily Television Infrared Observation Satellite (TIROS) Operational Vertical Sounder (TOVS) precipitation. The frequency of rain days in the TOVS is scaled down to match that in the TMPI at the data boundaries, and the resulting non-zero TOVS values are scaled locally to sum to the SG (which is a globally complete monthly product). The time series of the daily 1DD global images shows good continuity in time and across the data boundaries. Various examples are shown to illustrate uses. Validation for individual grid -box values shows a very high root-mean-square error but, it improves quickly when users perform time/space averaging according to their own requirements.

Author

Precipitation (Meteorology); Satellite Observation; Atmospheric Sounding; Infrared Radiation; Microwave Imagery; Climatology

20000068520 NASA Goddard Space Flight Center, Greenbelt, MD USA

South American Summer Monsoon of 1997/1998 and 1998/1999

Lau, William K.–M., NASA Goddard Space Flight Center, USA; Zhou, Jiayu, SM and A Corp., USA; [2000]; 4p; In English; 6th; 6th; Climate Diagnostics and Prediction, 1-5 Nov. 1999, Tucson, AZ, Santiago, USA, Chile; Sponsored by American Meteorological Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

It is well known that during El Nino years severe drought occurs in the area of Amazon and northeastern Brazil. According to the linear model result the reduced latent heating over the Amazon may lead to a weaker than normal upper tropospheric Bolivian high. As a result, some studies have suggested a weaker South American summer monsoon (SASM) during El Nino years. Using re-analysis. Zhou and Lau data found a statistically significant positive correlation between the tropical eastern Pacific sea surface temperature (SST) and the strength of low-level jet (LLJ) along the eastern foothills of the tropical-subtropical Andes. Douglas also showed a strong LLJ at Santa Cruz, Bolivia during a special pilot balloon observation period in 1997/98 El Nino austral summer. Since this LLJ is an integral part of the monsoon system in the summertime, these results indicated that SASM could be stronger than normal in El Nino years. to clarify this issue, we conducted an investigation on SASM anomaly in the recent ENSO event of 1997/98 El Nino and 1998/99 La Nina In the following we first give a brief review on SASM and the interannual variability of summer rainfall over South America. Then, the impact of 1997-99 ENSO on the South American regional thermal structure and its dynamical consequences to SASM will be discussed.

Author

Amazon Region (South America); Drought; El Nino; Jet Streams (Meteorology); Monsoons; Sea Surface Temperature; Southern Oscillation; Atmospheric Circulation; Air Water Interactions

20000068929 NASA Langley Research Center, Hampton, VA USA
Evaluation of Terms in the Water Vapor Budget Using Airborne Dial and In Situ Measurements from the Southern Great Plans 1997 Experiment
Senff, Christoph J., Colorado Univ., USA; Davis, Kenneth J., Minnesota Univ., USA; Lenschow, Donald H., National Center for Atmospheric Research, USA; Browell, Edward V., NASA Langley Research Center, USA; Ismail, Syed, NASA Langley Research Center, USA; [1998], pp. 462-464; In English

The Southern Great Plains (SGP97) field experiment was conducted in Oklahoma during June and July 1997 primarily to validate soil moisture retrieval algorithms using microwave radiometer measurements from aircraft as well as in situ surface measurements. One important objective of the SGP97 experiment plan was to examine the effect of soil moisture on the evolution of the atmospheric boundary layer (ABL) and clouds over the Southern Great Plains during the warm season. to support boundary layer studies during SGP97. the NASA Langley Research Center's Lidar Atmospheric Sensing Experiment (LASE) was flown on a NASA-P3 aircraft in conjunction with the Electronically Scanned Thinned Array Radiometer (ESTAR). The LASE instrument is an airborne, downward-looking differential absorption lidar (DIAL) system capable of measuring water vapor concentration as well as aerosol backscatter with high horizontal and vertical resolution in the ABL. Here, we will demonstrate how the LASE data can be used to determine water vapor statistics and most of the water vapor budget terms in the ABL. This information can then be related to spatial variations in soil moisture and the surface energy budget. The extensive surface and aircraft in situ measurements conducted during SGP97 provide information on the ABL that cannot be retrieved from the LASE data alone and also offer an excellent opportunity to validate the remote water vapor budget measurements with LASE.
Author
Evaluation; Water Vapor; Water Balance; Soil Moisture; Energy Budgets; Boundary Layers

20000069379 North Carolina State Univ., Dept. of Marine, Earth and Atmospheric Sciences, Raleigh, NC USA
Multi-Stream Model for Vertical Mixing of a Passive Tracer in the Convective Boundary Layer
Han, J.; Byun, D. W.; 1999; 10p; In English

We study a multi-stream model (MSM) for vertical mixing of a passive tracer in the convective boundary layer, in which the tracer is advected by many vertical streams with different probabilities and diffused by small scale turbulence. We test the MSM algorithm for investigating the effects of inhomogeneous mixing and vertical transport of multiple pollutants at different source heights in a three-dimensional air quality model. All input parameters in the MSM such as the probability density function and the mean updraft and downdraft are prescribed from large-eddy simulation (LES) data and the mixed-layer similarity theory. Applicability of the MSM is tested against the LES results for both near surface and elevated tracer sources. Results from the MSM compare well with those from LES for the overall temporal behavior of concentration distributions. However, a somewhat poor agreement between the MSM and LES is seen in the magnitude of the concentrations at the surface and in the entrainment zone. It suggests that a further improvement of the MSM is needed to account for the frictional effects at the surface and the diffusion by small scale turbulence in the entrainment zone.
NTIS
Streams; Convective Flow; Boundary Layer Flow; Vertical Air Currents; Convection Currents

20000069851 Naval Postgraduate School, Monterey, CA USA
A Composite Study of the Madden-Julian Oscillation and Northeasterly Cold-Surges During the Northern Winter Monsoon
Simms, John W., IV; Mar. 2000; 103p; In English

During the northern winter monsoon, the Madden-Julian Oscillation (MJO) and northeasterly cold-surges are active over the eastern Indian Ocean and western Pacific. The MJO consists of an active (wet) phase and inactive (dry) phase and varies over global spatial and intraseasonal time scales. Interactions between the MJO and northeasterly cold-surges, which vary over regional space and synoptic time scales, are examined. The interactions are examined between 1979-1998 using winds at 1000 hPa and a representation of convection during the northern winter monsoon. to identify interactions, the active and inactive phases of the MJO are divided into early or late phases (based on MJO duration). Examination of composite maps based on cold-surges defined to occur during each phase of the MJO revealed that the phase of the MJO acts to either enhance or weaken a cold-surge that may have been forced by the mid-latitudes. When MJO convection is located over the South China Sea, the surge intensifies. The favorable convection pattern dominates the unfavorable pressure-wind pattern of the MJO. When the MJO dry-phase is over the South

China Sea, mid-latitude forcing appears to interact favorably with the pressure-wind pattern of the MJO to dominate the unfavorable MJO convection pattern.
DTIC
Air Water Interactions; Monsoons; Atmospheric Circulation

20000070334 Woods Hole Oceanographic Inst., MA USA

Pan American Climate Study (PACS) Data Report

Anderson, Steven P.; Huang, Kelan; Brink, Nancy J.; Baumgartner, Mark F.; Weller, Robert A.; Mar. 2000; 151p; In English
Contract(s)/Grant(s): NA96GPO428
Report No.(s): AD-A377890; WHOI-TR-2000-03; UOP-TR-00-01; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The surface mooring component of the NOAA Pan American Climate Study (PACS) took place from April 1997 to September 1998 in the eastern tropical Pacific. PACS was a NOAA funded study with the goal of investigating links between sea surface temperature variability in the tropical oceans near the Americas and climate over the American continents. Two air-sea interaction surface moorings were deployed along 125 deg W, spanning a strong meridional sea-surface temperature gradient. One mooring site was located in the cold tongue south of the equator, and the other site was in the region of warm ocean found north of the equator, near the northernmost summer location of the Intertropical Convergence Zone. The moorings were deployed to improve our understanding of air-sea fluxes and the processes that control the evolution of the sea surface temperature field in the region. Four air-sea interaction buoys were deployed to occupy two sites for a period of 17 months. The sites were along 125 W near 3 deg S and 10 deg N. The Upper Ocean Processes Group at WHOI deployed the first two moorings in April 1997. These moorings were replaced with a second pair of moorings in December 1997. The final recovery occurred in September 1998. Each of these buoys on these moorings were equipped with meteorological instrumentation, including a Vector Averaging Wind Recorder (VAWR) and an Improved METeorological (IMET) system. The moorings also carried Vector Measuring Current Meters (VMCMS), single point temperature recorders and a few conductivity sensors on the mooring line to monitor the upper 200m of the ocean. In addition to the traditional instruments, several other experimental instruments were deployed with limited success on the mooring line including acoustic current meters, acoustic rain gauges and bio-optical instrument packages.
DTIC
Climate; Temperature Distribution; Bioacoustics; Vector Currents; Tropical Regions

20000070366 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Retrieval Assimilation and Modeling of Atmospheric Water Vapor from Ground- and Space-Based GPS Networks: Investigation of the Global and Regional Hydrological Cycles

Dickey, Jean O., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 12; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Uncertainty over the response of the atmospheric hydrological cycle (particularly the distribution of water vapor and cloudiness) to anthropogenic forcing is a primary source of doubt in current estimates of global climate sensitivity, which raises severe difficulties in evaluating its likely societal impact. Fortunately, a variety of advanced techniques and sensors are beginning to shed new light on the atmospheric hydrological cycle. One of the most promising makes use of the sensitivity of the Global Positioning System (GPS) to the thermodynamic state, and in particular the water vapor content, of the atmosphere through which the radio signals propagate. Our strategy to derive the maximum benefit for hydrological studies from the rapidly increasing GPS data stream will proceed in three stages: (1) systematically analyze and archive quality-controlled retrievals using state-of-the-art techniques; (2) employ both currently available and innovative assimilation procedures to incorporate these determinations into advanced regional and global atmospheric models and assess their effects; and (3) apply the results to investigate selected scientific issues of relevance to regional and global hydrological studies. An archive of GPS-based estimation of total zenith delay (TZD) data and water vapor where applicable has been established with expanded automated quality control. The accuracy of the GPS estimates is being monitored; the investigation of systematic errors is ongoing using comparisons with water vapor radiometers. Meteorological packages have been implemented. The accuracy and utilization of the TZD estimates has been improved by implementing a troposphere gradient model. GPS-based gradients have been validated as real atmospheric moisture gradients, establishing a link between the estimated gradients and the passage of weather fronts. We have developed a generalized ray tracing inversion scheme that can be used to analyze occultation data acquired from space- or land-based receivers. The National Center for Atmospheric Research mesoscale model (version MM5) has been adapted for Southern California, and assimilation studies are underway. Additional information is contained in the original.
Author
Atmospheric Models; Atmospheric Moisture; Climatology; Cloud Cover; Hydrological Cycle; Water Vapor; Climate Change

20000070368 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Tests of Radar Rainfall Retrieval Algorithms

Durden, Stephen L., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 14; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The NASA/JPL Airborne Rain Mapping Radar (ARMAR) operates at 14 GHz. ARMAR flew on the NASA DC-8 aircraft during Tropical Ocean Global Atmosphere (TOGA) Coupled Ocean Atmosphere Response Experiment (COARE), collecting data in oceanic mesoscale convective systems, similar to those now being observed by the Tropical Rainfall Measuring Mission (TRMM) satellite, which includes a 14-GHz precipitation radar. Several algorithms for retrieving rain rate from downward looking radars are in existence. These can be categorized as deterministic and stochastic. Deterministic algorithms use the path integrated attenuation (PIA), measured by the surface reference technique, as a constraint. One deterministic algorithm corrects the attenuation-rainfall (k-R) relation, while another corrects the reflectivity rainfall (ZR) relation. Stochastic algorithms apply an Extended Kalman Filter to the reflectivity profile. One employs radar reflectivity only; the other additionally uses the PIA. We find that the stochastic algorithm with PIA is the most robust algorithm with regard to incorrect assumptions about the drop-size distribution (DSD). The deterministic algorithm that uses the PIA to adjust the Z-R relation is also fairly robust and produces rain rates similar to the stochastic algorithm that uses the PIA. The deterministic algorithm that adjusts only the k-R relation and the stochastic radar-only algorithm are more sensitive to assumptions about the DSD. It is likely that they underestimate convective rainfall, especially if the DSD is erroneously assumed to be appropriate for stratiform rain conditions. The underestimation is illustrated in the diagram. The algorithm labeled D IS initially assumes a DSD that is appropriate for stratiform. rain, while the rain is most likely convective. The PIA constraint causes the k-R relation to be adjusted, resulting in a much lower rain rate than the other algorithms. Additional information is contained in the original.

Author

Algorithms; Mesoscale Phenomena; Precipitation (Meteorology); Rain; Hydrology; Climatology; Hydrometeorology

20000070373 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Remote Sensing of Rain

Haddad, Ziad S., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 19; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The first problem addressed concerns passive-microwave rain retrievals. Most current approaches start by building off-line a cloud-model-derived database. Given data, the retrieval algorithms search the database for the microwave temperatures "closest" to the observed data, then after some fine-tuning (performed in different ways by different implementations) the rain is estimated to be that which corresponds to the selected (and fine-tuned) set of database temperatures. These approaches have three drawbacks: they cannot properly take into account the ambiguities which arise from the fact that several rain scenarios can produce the same observed temperatures; they are quite inefficient since they require manipulating a large database along with often complex "fine-tuning" procedures; and they cannot refine their estimates if additional data is available. This past year we have derived closed formulae relating observed microwave brightness temperatures, T_b, and the underlying rain rates, R: average $T_b = f$ (rain) and average rain $= g$ (T_b), along with the corresponding covariance matrices. These results are sufficient to describe the conditional probabilities $p(R/T_b)$ and $p(T_b/R)$ to second order. Progress has also been made towards deriving a robust description of the rain drop size distribution (DSD). The widespread approach consisting in parameterizing the DSD as a gamma-distribution in terms of the drop diameter D suffers from the facts that, in reality, the DSD is not a smooth function of D and that the largely arbitrary Gamma model imposes unintended behavior, which has implications on any quantities derived from the DSD model. We have therefore developed a non-parametric yet practical description of the DSD, which is particularly well-suited for use in remote-sensing applications. The diagram on the left shows a comparison between an actual DSD sample and the truncated non-parametric representation. One figure shows the relation between radar reflectivity and rain rate derived using this representation. Validation of the Tropical Rainfall Measuring Mission (TRMM) radar-radiometer combined R and DSD algorithm is underway. This algorithm was designed to make optimal use of the instantaneous reflectivity profiles measured by the TRMM radar and the microwave brightness temperatures measured by the TRMM passive radiometer. So far, it appears to be the most reliable TRMM rain algorithm.

Author

Algorithms; Atmospheric Models; Rain; Remote Sensing; Proving

20000070376 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Micro Weather Station

Hoenk, Michael E., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 22; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Improved in situ meteorological measurements in the troposphere and stratosphere are needed for studies of weather and climate, both as a primary data source and as validation for remote sensing instruments. Following the initial development and successful flight validation of the surface acoustic wave (SAW) hygrometer, the micro weather station program was directed toward the development of an integrated instrument, capable of accurate, in situ profiling of the troposphere, and small enough to fly on a radiosonde balloon for direct comparison with standard radiosondes. On April 23, 1998, working with Frank Schmidlin and Bob Olson of Wallops Island Flight Facility, we flew our instrument in a dual payload experiment, for validation and direct comparison with a Vaisala radiosonde. During that flight, the SAW dewpoint hygrometer measured frostpoint down to -76T at 44,000 feet. Using a laptop computer in radio contact with the balloon, we monitored data in real time, issued the cutdown command, and recovered the payload less than an hour after landing in White Sands Missile Range, 50 miles from the launch site in Hatch, New Mexico. Future flights will extend the intercomparison, and attempt to obtain in situ meteorological profiles from the surface through the tropopause. The SAW hygrometer was successfully deployed on the NASA DC8 as part of NASA's Third Convection and Moisture Experiment (CAMEX-3) during August and September, 1998. This field campaign was devoted to the study of hurricane tracking and intensification using NASA-funded aircraft. In situ humidity data from the SAW hygrometer are currently being analyzed and compared with data from other instruments on the DC8 and ER2 aircraft. Additional information is contained in the original.
Author
Dew Point; Humidity; Hygrometers; Meteorological Parameters; Radiosondes; Weather Stations; Troposphere; Stratosphere

20000070386 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Wind Field Measurements With Airborne Doppler Lidar
Menzies, Robert T., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 32; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In collaboration with lidar atmospheric remote sensing groups at NASA Marshall Space Flight Center and National Oceanic and Atmospheric Administration (NOAA) Environmental Technology Laboratory, we have developed and flown the Multi-center Airborne Coherent Atmospheric Wind Sensor (MACAWS) lidar on the NASA DC-8 research aircraft. The scientific motivations for this effort are: to obtain measurements of subgrid scale (i.e. 2-200 km) processes and features which may be used to improve parameterizations in global/regional-scale models; to improve understanding and predictive capabilities on the mesoscale; and to assess the performance of Earth-orbiting Doppler lidar for global tropospheric wind measurements. MACAWS is a scanning Doppler lidar using a pulsed transmitter and coherent detection; the use of the scanner allows 3-D wind fields to be produced from the data. The instrument can also be radiometrically calibrated and used to study aerosol, cloud, and surface scattering characteristics at the lidar wavelength in the thermal infrared. MACAWS was used to study surface winds off the California coast near Point Arena, with an example depicted in the figure below. The northerly flow here is due to the Pacific subtropical high. The coastal topography interacts with the northerly flow in the marine inversion layer, and when the flow passes a cape or point that juts into the winds, structures called "hydraulic expansion fans" are observed. These are marked by strong variation along the vertical and cross-shore directions. The plots below show three horizontal slices at different heights above sea level (ASL). Bottom plots are enlargements of the area marked by dotted boxes above. The terrain contours are in 200-m increments, with the white spots being above 600-m elevation. Additional information is contained in the original.
Author
Atmospheric Circulation; Doppler Radar; Meteorological Radar; Optical Radar; Wind (Meteorology); Wind Measurement; Wind Velocity

20000070391 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Submillimeter-Wave Cloud Ice Radiometry
Walter, Steven J., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 37; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Submillimeter-wave cloud ice radiometry is a new and innovative technique for characterizing cirrus ice clouds. Cirrus clouds affect Earth's climate and hydrological cycle by reflecting incoming solar energy, trapping outgoing IR radiation, sublimating into vapor, and influencing atmospheric circulation. Since uncertainties in the global distribution of cloud ice restrict the accuracy of both climate and weather models, successful development of this technique could provide a valuable tool for investigating how clouds affect climate and weather. Cloud ice radiometry could fill an important gap in the observational capabilities of existing and planned Earth-observing systems. Using submillimeter-wave radiometry to retrieve properties of ice clouds can be understood with a simple model. There are a number of submillimeter-wavelength spectral regions where the upper troposphere is transparent. At lower tropospheric altitudes water vapor emits a relatively uniform flux of thermal radiation. When cirrus clouds are present, they scatter a portion of the upwelling flux of submillimeter-wavelength radiation back towards the Earth as shown in the diagram,

thus reducing the upward flux o f energy. Hence, the power received by a down-looking radiometer decreases when a cirrus cloud passes through the field of view causing the cirrus cloud to appear radiatively cool against the warm lower atmospheric thermal emissions. The reduction in upwelling thermal flux is a function of both the total cloud ice content and mean crystal size. Radiometric measurements made at multiple widely spaced frequencies permit flux variations caused by changes in crystal size to be distinguished from changes in ice content, and polarized measurements can be used to constrain mean crystal shape. The goal of the cloud ice radiometry program is to further develop and validate this technique of characterizing cirrus. A multi-frequency radiometer is being designed to support airborne science and spacecraft validation missions. This program has already extended the initial millimeter-wave modeling studies to submillimeter-wavelengths and has improved the realism of the cloud scattering models. Additionally a proof-of-concept airborne submillimeter-wave radiometer was constructed and fielded. It measured a radiometric signal from cirrus confirming the basic technical feasibility of this technique. This program is a cooperative effort of the University of Colorado, Colorado State University, Swales Aerospace, and Jet Propulsion Laboratory. Additional information is contained in the original.
Author
Airborne Equipment; Cirrus Clouds; Ice Clouds; Submillimeter Waves

20000070459 NASA Goddard Space Flight Center, Greenbelt, MD USA
Predictability of the 1997 and 1998 South Asian Summer Monsoons
Schubert, Siegfred D., NASA Goddard Space Flight Center, USA; Wu, Man Li, NASA Goddard Space Flight Center, USA; May 01, 2000; 26p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    The predictability of the 1997 and 1998 south Asian summer monsoon winds is examined from an ensemble of 10 Atmospheric General Circulation Model (AGCM) simulations with prescribed sea surface temperatures (SSTs) and soil moisture, The simulations are started in September 1996 so that they have lost all memory of the atmospheric initial conditions for the periods of interest. The model simulations show that the 1998 monsoon is considerably more predictable than the 1997 monsoon. During May and June of 1998 the predictability of the low-level wind anomalies is largely associated with a local response to anomalously warm Indian Ocean SSTs. Predictability increases late in the season (July and August) as a result of the strengthening of the anomalous Walker circulation and the associated development of easterly low level wind anomalies that extend westward across India and the Arabian Sea. During these months the model is also the most skillful with the observations showing a similar late-season westward extension of the easterly CD wind anomalies. The model shows little predictability or skill in the low level winds over southeast Asia during, 1997. Predictable wind anomalies do occur over the western Indian Ocean and Indonesia, however, over the Indian Ocean they are a response to SST anomalies that were wind driven and they show no skill. The reduced predictability in the low level winds during 1997 appears to be the result of a weaker (compared with 1998) simulated anomalous Walker circulation, while the reduced skill is associated with pronounced intraseasonal activity that is not well captured by the model. Remarkably, the model does produce an ensemble mean Madden-Julian Oscillation (MJO) response that is approximately in phase with (though weaker than) the observed MJ0 anomalies. This is consistent with the idea that SST coupling may play an important role in the MJO.
Author
Monsoons; Atmospheric General Circulation Models; Meteorology; Oscillations; Predictions; Sea Surface Temperature

20000070464 NASA Goddard Space Flight Center, Greenbelt, MD USA
Fallspeeds and Vertical Air Motions in Stratiform Rain Derived from ER-2 Doppler Radar Observations
Heymsfield, G. M., NASA Goddard Space Flight Center, USA; Tian, L., Universities Space Research Association, USA; [2000]; 3p; In English; ICCP Conference, 14-18 Aug. 2000, Reno, NV, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
    The Tropical Rain Measuring Mission (TRMM) conducted several intensive field validation campaigns for improved understanding of Tropical precipitation systems. Two of the campaigns (TEFLUN in Florida and Texas, and LBA in Brazil) utilized: the NASA ER-2 high-altitude (20 km) remote sensing aircraft instrumented with the ER-2 Doppler Radar (EDOP), the University of North Dakota Citation microphysics aircraft, and the NCAR S-POL polarization radar. This paper focuses on EDOP-derived fallspeeds and vertical velocities in the rain regions of two stratiform cases (5 September 1998 along the east coast of Florida, and 17 February 1999 in Amazonia in Brazil). These cases were sampled in situ microphysically by the Citation and reported elsewhere in this meeting; the main emphasis of this paper will be on the airborne radar measurements and inferences from them.
Author
Trmm Satellite; Remote Sensing; Rain; Radar Measurement; Airborne Radar

20000070466 NASA Goddard Space Flight Center, Greenbelt, MD USA

Radiative-Convective Processes in Regulating Tropical Ocean-Atmosphere

Sui, C.–H., NASA Goddard Space Flight Center, USA; Lau, K.–M., NASA Goddard Space Flight Center, USA; Li, X., NASA Goddard Space Flight Center, USA; Ho, C.–H., Seoul National Univ., Korea, Republic of; [2000]; 2p; In English; 24th; Hurricanes, 29 May - 2 Jun. 2000, Fort Lauderdale, FL, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Relationship between sea surface temperature (SST) and cloud/water vapor reveals important information about radiative-climate feedbacks. Many previous studies have found that cloud amount and SST are positively correlated for SST between 28-29.5 C, for SST greater than 29.5 C, cloud amount actually decreases with increasing SST. The breakdown of SST-cloud correlation at 29.5 C was suggested to be related to the formation of localized hot spots with very high SST due to increased solar radiation in regions of strong subsidence forced by convection elsewhere. In this study, the breakdown is related to the radiative cooling in the subsidence regime over the cold pool surrounding the warm pool. We show model and observational evidence that radiative cooling over the cold pool limits the strength of SST-induced tropical circulation. As a result, occurrence of convection is also limited when SST contrast between the warm pool and cold pool is large.

Derived from text

Air Water Interactions; Tropical Regions; Sea Surface Temperature; Clouds (Meteorology); Radiative Heat Transfer; Forced Convection

20000070468 NASA Goddard Space Flight Center, Greenbelt, MD USA

Forward Monte Carlo Computations of Polarized Microwave Radiation

Battaglia, A., Ferrara Univ., Italy; Kummerow, C., NASA Goddard Space Flight Center, USA; [2000]; 4p; In English; Clouds and Precipitation, 14-18 Aug. 2000, Reno, NV, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Microwave radiative transfer computations continue to acquire greater importance as the emphasis in remote sensing shifts towards the understanding of microphysical properties of clouds and with these to better understand the non linear relation between rainfall rates and satellite-observed radiance. A first step toward realistic radiative simulations has been the introduction of techniques capable of treating 3-dimensional geometry being generated by ever more sophisticated cloud resolving models. to date, a series of numerical codes have been developed to treat spherical and randomly oriented axisymmetric particles. Backward and backward-forward Monte Carlo methods are, indeed, efficient in this field. These methods, however, cannot deal properly with oriented particles, which seem to play an important role in polarization signatures over stratiform precipitation. Moreover, beyond the polarization channel, the next generation of fully polarimetric radiometers challenges us to better understand the behavior of the last two Stokes parameters as well. In order to solve the vector radiative transfer equation, one-dimensional numerical models have been developed, These codes, unfortunately, consider the atmosphere as horizontally homogeneous with horizontally infinite plane parallel layers. The next development step for microwave radiative transfer codes must be fully polarized 3-D methods. Recently a 3-D polarized radiative transfer model based on the discrete ordinate method was presented. A forward MC code was developed that treats oriented nonspherical hydrometeors, but only for plane-parallel situations.

Derived from text

Mathematical Models; Microwaves; Monte Carlo Method; Polarized Radiation; Radiative Heat Transfer

20000070469 NASA Goddard Space Flight Center, Greenbelt, MD USA

Profiling of Atmospheric Water Vapor from the SSM/T-2 Radiometric Measurements

Wang, J. R., NASA Goddard Space Flight Center, USA; [2000]; 3p; In English; International Geoscience and Remote Sensing, 24-28 Jul. 2000, Honolulu, HI, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An advantage of using the millimeter-wave measurements for water vapor profiling is the ability to probe beyond a moderate cloud cover. Such a capability has been demonstrated from an airborne MIR (Millimeter-wave Imaging Radiometer) flight over the Pacific Ocean during an intense observation period of TOGA/COARE (Tropical Ocean Global Atmosphere/ Couple Ocean Atmospheric Response Experiment) in early 1993. A Cloud Lidar System (CLS) and MODIS Airborne Simulator (MAS) were on board the same aircraft to identify the presence of clouds and cloud type. The retrieval algorithm not only provides output of a water vapor profile, but also the cloud liquid water and approximate cloud altitude required to satisfy convergence of the retrieval. The validity of these cloud parameters has not been verified previously. In this document, these cloud parameters are compared with those derived from concurrent measurements from the CLS and AMPR (Advanced Microwave Precipitation Radiometer).

Author

Atmospheric Moisture; Cloud Cover; Clouds (Meteorology); Microwave Radiometers

20000070515 National Weather Service, Climate Prediction Center, Camp Springs, MD USA

Proceedings of the Annual Climate Diagnostics and Prediction Workshop

2000; 426p; In English, 5-9 Nov. 1999, Tucson, AZ, USA

Report No.(s): PB2000-106012; No Copyright; Avail: CASI; A04, Microfiche; A19, Hardcopy

    Table of Contents: Review of Recent Climate Anomalies and Forecasts; Weather and Climate of the U.S. Southwest: General (Precipitation, Hydrology, Temperature, Other Aspects); Weather and Climate of the U.S. Southwest: The North American Monsoon; Climate and Hydrological Issues of the Southwestern U.S. and Climate Applications Such as Human Health; ENSO and Other Tropical Air-Ocean Climate Processes; ENSO Impacts on Climate-Local and Remote; Climate Diagnosis and Prediction on Intraseasonal to Interdecadal Time Scales; Impacts of Climate Variability, Including Human Health; Intraseasonal Variability; Models and Model Studies; Tropical Rainfall and Monsoons; Interdecadal Variability and Trends; Links Between Extreme Events and Climate Variability; and Climate Monitoring, Data Sets and Data Access.

NTIS

Predictions; Weather Forecasting; Conferences; Climatology

20000070672 Risoe National Lab., Meteorology and Wind Energy Dept., Roskilde, Denmark

Meteorological observations in support of a hill cap cloud experiment

Nielsen, M.; Jun. 30, 1998; 43p; In English

Report No.(s): DE99-701960; RISO-R-1032(EN); ISBN 87-550-2364-9; No Copyright; Avail: Department of Energy Information Bridge

    Humid air flows form a hill cap cloud over the Agana mountain ridge in the north-east of Tenerife. The HILLCLOUD project utilised this cloud formation to investigate the chemical and physical properties of cloud aerosols by land based observations. The project was part of the second Aerosol characterisation Experiment (ACE-2) of the International Global Atmospheric chemistry project (IGAC). The present report describes meteorological observations in support of the hill cap cloud experiment. Time-series of wind speed, wind direction, temperature and humidity were collected at ground-based meteorological stations during a period starting one year in advance of the main campaign. A series of radiosonde detecting the upstream stability and wind profile were launched during the main campaign.

NTIS

Cap Clouds; Meteorological Parameters; Meteorology; Atmospheric Chemistry; Aerosols; Air Flow

20000070719 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Influence of Soil Moisture, Coastline Curvature, and Land-Breeze Circulations on Sea-Breeze Initiated Precipitation

Baker, David R., NASA Goddard Space Flight Center, USA; Lynn, Barry H., NASA Goddard Space Flight Center, USA; Boone, Aaron, CNRM, France; Tao, Wei–Kuo, NASA Goddard Space Flight Center, USA; Simpson, Joanne, NASA Goddard Space Flight Center, USA; [2000]; 59p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

    Idealized numerical simulations are performed with a coupled atmosphere/land-surface model to identify the roles of initial soil moisture, coastline curvature, and land breeze circulations on sea breeze initiated precipitation. Data collected on 27 July 1991 during the Convection and Precipitation Electrification Experiment (CAPE) in central Florida are used. The 3D Goddard Cumulus Ensemble (GCE) cloud resolving model is coupled with the Goddard Parameterization for Land-Atmosphere-Cloud Exchange (PLACE) land surface model, thus providing a tool to simulate more realistically land-surface/atmosphere interaction and convective initiation. Eight simulations are conducted with either straight or curved coast-lines, initially homogeneous soil moisture or initially variable soil moisture, and initially homogeneous horizontal winds or initially variable horizontal winds (land breezes). All model simulations capture the diurnal evolution and general distribution of sea-breeze initiated precipitation over central Florida. The distribution of initial soil moisture influences the timing, intensity and location of subsequent precipitation. Soil moisture acts as a moisture source for the atmosphere, increases the connectively available potential energy, and thus preferentially focuses heavy precipitation over existing wet soil. Strong soil moisture-induced mesoscale circulations are not evident in these simulations. Coastline curvature has a major impact on the timing and location of precipitation. Earlier low-level convergence occurs inland of convex coastlines, and subsequent precipitation occurs earlier in simulations with curved coastlines. The presence of initial land breezes alone has little impact on subsequent precipitation. however, simulations with both coastline curvature and initial land breezes produce significantly larger peak rain rates due to nonlinear interactions.

Author

Soil Moisture; Curvature; Coasts; Sea Breeze; Circulation; Precipitation (Meteorology); Numerical Analysis; Atmospheric Models

NASA Goddard Space Flight Center, Greenbelt, MD USA

Comparison of Cirrus Cloud Models: A Project of the GEWEX Cloud System Study (GCSS) Working Group on Cirrus Cloud Systems

Starr, David O'C., NASA Goddard Space Flight Center, USA; Benedetti, Angela, Colorado State Univ., USA; Boehm, Matt, NASA Goddard Space Flight Center, USA; Brown, Philip R. A., Meteorological Office, UK; Gierens, Klaus M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Girard, Eric, Colorado Univ., USA; Giraud, Vincent, Universite des Sciences et Techniques de Lille Flandres Artois, France; Jakob, Christian, European Centre for Medium-Range Weather Forecasts, UK; Jensen, Eric, NASA Ames Research Center, USA; [2000]; 4p; In English; International Conference on Cloud Physics and Precipitation, 14 Aug. 2000, Reno, NV, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The GEWEX Cloud System Study (GCSS, GEWEX is the Global Energy and Water Cycle Experiment) is a community activity aiming to promote development of improved cloud parameterizations for application in the large-scale general circulation models (GCMs) used for climate research and for numerical weather prediction. The GCSS strategy is founded upon the use of cloud-system models (CSMs). These are "process" models with sufficient spatial and temporal resolution to represent individual cloud elements, but spanning a wide range of space and time scales to enable statistical analysis of simulated cloud systems. GCSS also employs single-column versions of the parametric cloud models (SCMs) used in GCMs. GCSS has working groups on boundary-layer clouds, cirrus clouds, extratropical layer cloud systems, precipitating deep convective cloud systems, and polar clouds.
Derived from text
Atmospheric General Circulation Models; Cirrus Clouds; Numerical Weather Forecasting; Parameterization

NASA Marshall Space Flight Center, Huntsville, AL USA

Passive Microwave Observations of Hurricanes Bonnie, Danielle, and Georges

Hood, Robbie E., NASA Marshall Space Flight Center, USA; Guillory, Anthony, NASA Marshall Space Flight Center, USA; LaFontaine, Frank J., Raytheon ITSS, USA; [2000]; 1p; In English; 24th; Hurricanes and Tropical Meteorology, 29 May - 2 Jun. 2000, Fort Lauderdale, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

During the 1998 hurricane season, three hurricanes were sampled by the Advanced Microwave Precipitation Radiometer (AMPR) which was flown aboard the National Aeronautics and Space Administration (NASA) ER-2 high altitude aircraft during the Third Convection and Moisture EXperiment (CAMEX-3). The ER-2 aircraft was deployed from Patrick Air Force Base, Florida for hurricane missions over the Atlantic Basin and Gulf of Mexico between 6 August - 23 September. Hurricanes Bonnie, Danielle and Georges were each sampled multiple times during several subsequent aircraft missions. The passive microwave observations of these hurricanes collected by the AMPR at 10.7, 19.35, 37.1, and 85.5 GHz frequencies will be presented to explain differences in precipitation features of the hurricanes. In particular, the relationship of the passive microwave signatures of precipitation-sized ice to vertical updraft strength will be examined as a possible indicator of future convective intensity. Correlating aircraft radar information will also be examined to provide further insight.
Author
Microwave Radiometers; Precipitation (Meteorology); Hydrology; Climatology; Microwave Signatures; Hurricanes

NASA Marshall Space Flight Center, Huntsville, AL USA

Tornadic Supercells on May 3, 1999 Viewed from Space During an Overpass of the NASA TRMM Observatory

Goodman, Steven J., NASA Marshall Space Flight Center, USA; Buechler, Dennis, NASA Marshall Space Flight Center, USA; Driscoll, Kevin, NASA Marshall Space Flight Center, USA; Burgess, Donald W., National Weather Service, USA; Magsig, Michael A., Oklahoma Univ., USA; [2000]; 1p; In English; Severe Storms, 11-15 Sep. 2000, Orlando, FL, USA; No Copyright; Avail: Issuing Activity; Abstract Only

At approximately 04:00 UTC on 4 May (23:00 CDT on 3 May) 1999 the NASA Tropical Rainfall Measuring Mission (TRMM) Observatory made an overpass during the Central Oklahoma tornado outbreak. Supercells D4 and G5 were observed by a unique suite of scientific instruments aboard TRMM. The TRMM observatory was launched in November 1997 into a low earth orbit providing global coverage of storms from 35 degrees N latitude to 35 degrees S latitude from an altitude of 350 km. The instruments include the Lighting Imaging Sensor (LIS) which measures total lighting activity (in-cloud as well as cloud-to-ground), the TRMM Microwave Imager (TMI) which measures precipitation and cloud microphysical characteristics, the Precipitation Radar (PR) which is the first meteorological radar flown in low earth orbit, and the Visible/InfraRed Sensor (VIRS) which measures cloud top characteristics such as cloud top temperature in the visible and infrared with high (2 km) spatial resolution. Supercell D4 at Stroud, Oklahoma produced the greatest lightning rates (exceeding 225 flashes per minute) observed worldwide

to date by the LIS. The presentation will present detailed satellite and ground based observations of the supercells observed during the TRMM overpass.

Author

Cloud-to-Ground Discharges; Imaging Techniques; Infrared Detectors; Microwave Imagery; Precipitation (Meteorology); Trmm Satellite

20000072435 NASA Goddard Space Flight Center, Greenbelt, MD USA

Radar Observation of Large Attenuation in Convective Storms: Implications for the Dropsize Distribution

Tian, Lin, Universities Space Research Association, USA; Heymsfield, G. M., NASA Goddard Space Flight Center, USA; Srivastava, R. C., Chicago Univ., USA; [2000]; 4p; In English; Clouds and Precipitation, 14-18 Aug. 2000, Reno, NV, USA

Contract(s)/Grant(s): NAG5-4777; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Airborne meteorological radars typically operate at attenuating wavelengths. The path integrated attenuation (PIA) can be estimated using the surface reference technique (SRT). In this method, an initial value is determined for the radar cross section of the earth surface in a rain-free area in relatively close proximity to the rain cloud. During subsequent observations of precipitation any decrease 'in the observed surface cross section from the reference value s assumed to be a result of the two-way attenuation along the propagation path. In this paper we present selected instances of high PIA observed over land by an airborne radar. The observations were taken in Brazil and Florida during TRMM (Tropical Rainfall Measurement Mission) field campaigns. We compared these observations with collocated and nearly simultaneous ground-based radar observations by an S-band radar that is not subject to significant attenuation. In this preliminary evaluation, a systematic difference in the attenuation in the two storms is attributed to a difference in the raindrop size distributions; this is supported by observations of ZDR (differential reflectivity).

Derived from text

Attenuation; Convection; Storms; Raindrops; Airborne Radar; Size Distribution; Radar Tracking

20000072436 NASA Goddard Space Flight Center, Greenbelt, MD USA

Hurricane Bonnie Landfalling Observed from ER-2 Doppler Radar on 26 August 1998 During CAMEX-3

Heymsfield, G. M., NASA Goddard Space Flight Center, USA; Halverson, J., Maryland Univ. Baltimore County, USA; Tian, L., Universities Space Research Association, USA; Geerts, B., Science Systems and Applications, Inc., USA; [2000]; 2p; In English; 24th; Hurricanes, 29 May - 2 Jun. 2000, Fort Lauderdale, FL, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The NASA ER-2 and DC-8 aircraft collected remote sensing and in situ data sets from Hurricane Bonnie (23, 24, and 26 August 1998) during the Convection And Moisture Experimental-3 (CAMEX-3). Bonnie was an exceptional case where NASA and NOAA had five aircraft sampling both upper levels and lower altitudes. The ER-2 was instrumented with the ER-2 Doppler XBand radar (EDOP) and several radiometers ranging from visible to lower frequency microwaves. EDOP is a fixed dual-beam radar (nadir and forward-looking beams) which allows computation of both vertical and alongtrack horizontal winds. The hurricane secondary circulation is typically difficult to measure at upper levels due to aircraft altitude limitations and sensitivity of the lower altitude airborne radars. EDOP is in principle, well suited to measure these components of the wind. When ER-2 flies across the approximate center of the hurricane circulation, the along-track winds derived from EDOP, are approximately equal to the hurricane radial flow comprising the secondary circulation. Assuming that the hydrometeor fallspeeds can be approximated, the radial and vertical wind components of the secondary circulation can be measured. Since the hydrometeor motions can be estimated with more confidence in the higher altitude ice regions (i.e., graupel and mixed phase are complicated at lower altitudes), the derived radial and vertical winds have higher accuracy at upper levels. On the other hand, the reflectivities are extremely low at higher altitudes, resulting in fewer Doppler velocity estimates.

Derived from text

Doppler Radar; Hurricanes; U-2 Aircraft; Convection; Remote Sensing; DC 8 Aircraft; Atmospheric Moisture

20000072442 NASA Goddard Space Flight Center, Greenbelt, MD USA

Role of Easterly Waves in the Maintenance of the African Easterly Jet

Ferreira, Rosana Nieto, Universities Space Research Association, USA; Suarez, Max, NASA Goddard Space Flight Center, USA; Bacmeister, Julio, Universities Space Research Association, USA; [2000]; 2p; In English; 24th; 24th Hurricanes Conference, 29 May - 2 Jun. 2000, Fort Lauderdale, FL, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

About fifty percent of all hurricanes in the Atlantic Ocean form within African easterly waves (AEW). Many previous studies have indicated that these waves result from combined barotropic-baroclinic instability of the African Easterly Jet (AEJ). The AEJ is in turn believed to be due to the strong temperature gradient between the very warm Sahara Desert and the cooler Sahel and

Gulf of Guinea to the south. Zonally averaged latitude-pressure cross-sections of summertime zonal winds over Africa show the AEJ as a 8-12 m/s jet centered at 600-700 mb near 15 N. Such cross-sections also show a weaker southern hemisphere easterly jet near 5-150S, monsoonal westerlies centered beneath the AEJ, and upper tropospheric features such as the Tropical Easterly Jet (TEJ) near 30N and the subtropical westerly jet near 35ON . Thomcroft and Blackburn performed zonally symmetric simulations that showed that the effect of thermal wind balance over the observed low level meridional temperature gradient over northern Africa is particularly important in the formation of the AEJ. They also found that in order to reproduce some of the other aforementioned features of the summertime climatological wind field over Africa it is necessary to include the effects of Inter-Tropical Convergence Zone (ITCZ) convective heating. While the diabatic effects of Saharan and ITCZ heating tend to strengthen the AEJ, AEW remove energy from the AEJ, thereby weakening it. In this study we take the next step towards understanding the maintenance of the AEJ by including the effects of AEW.
Author
Atmospheric Circulation; Baroclinic Instability; Hurricanes; Temperature Gradients; Wind (Meteorology); Wind Effects; Intertropical Convergent Zones; Climate Models

20000072474 Clarkson Univ., Dept. of Mathematics and Computer Science, Potsdam, NY USA
An Adaptive Multigrid Barotropic Tropical Cyclone Track Model
Fulton, Scott R.; Dec. 1999; 26p; In English
Contract(s)/Grant(s): N00014-98-1-0103; N00014-98-1-0368
Report No.(s): AD-A376987; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    This paper describes the application of adaptive multigrid techniques to the problem of tropical cyclone track prediction. Based on the nondivergent barotropic vorticity equation, the model uses an adaptive multigrid method to refine the mesh around the moving vortex. Like conventional nested-grid models, this model achieves nonuniform resolution by superimposing uniform grids of different mesh sizes. Unlike nested-grid models, multigrid processing uses the interplay between solutions on fine and coarse grids-in regions where they overlap-to: (1) solve the implicit problem for the stream- function with optimum efficiency, (2) automatically achieve two-way interaction at the grid interfaces, and (3) provide accurate truncation error estimates for use in determining where to refine or coarsen the grids. An exchange rate algorithm accomplishes the latter task, approximately optimizing the grid selection based on a user-specified tradeoff between accuracy and computational work. Numerical results demonstrate that the model chooses reasonable grids with minimal user intervention. Using adaptive mesh refinement is at least an order of magnitude more efficient than using a single uniform grid, and the overhead cost of adaptive regridding is less than two percent of the total execution time. The adaptive multigrid approach allows track prediction errors due to discretization to be essentially eliminated from the problem at a reasonable computational cost.
DTIC
Computational Grids; Cyclones; Mathematical Models; Tropical Storms; Vortices; Vorticity Equations

20000072495 Clarkson Univ., Dept. of Mathematics and Computer Science, Potsdam, NY USA
Comparison of Discretization Accuracy in an Adaptive Multigrid Barotropic Tropical Cyclone Track Model
Hu, Miao; Fulton, Scott R.; May 2000; 2p; In English; Presented at AMS Conference on Hurricanes and Tropical Meteorology (24th), Fort Lauderdale, FL, May 2000.
Contract(s)/Grant(s): N00014-98-1-0103; N00014-98-1-0368
Report No.(s): AD-A377011; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
    Among the many sources of error in modeling tropical cyclones is discretization error: how well are the governing equations approximated numerically? While discretization error is typically small, numerical methods with smaller errors should be preferred over others, all else being equal. This paper addresses the tradeoff between higher-accuracy discretization and increased computational work in an adaptive multigrid tropical cyclone track model.
DTIC
Cyclones; Tropical Storms; Mathematical Models; Finite Difference Theory; Multigrid Methods

20000072496 Clarkson Univ., Dept. of Mathematics and Computer Science, Potsdam, NY USA
Potential Vorticity Mixing in Hurricanes: Comparison of Nondivergent and Divergent Barotropic Vortices
Fulton, Scott R.; Schubert, Wayne H.; Montgomery, Michael T.; Jan. 1999; 3p; In English; Prepared in cooperation with Colorado State Univ., Fort Collins, CO. Presented at AMS Conference on Hurricanes and Tropical Meteorology (23rd), Dallas, TX, Jan 1999.
Contract(s)/Grant(s): N00014-98-1-0103; N00014-98-1-0368
Report No.(s): AD-A377013; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper concentrates on the minimum enstrophy vortex (MinEV) problem, generalizing previous results for the unforced nondivergent barotropic model and extending the analysis to the divergent barotropic (shallow water) model.
DTIC
Barotropism; Shallow Water; Vortices; Hurricanes; Mathematical Models; Pressure Gradients

20000072882 NASA Marshall Space Flight Center, Huntsville, AL USA
Tenth AMS Conference on Satellite Meteorology and Oceanography
Ferraro, R., NASA Marshall Space Flight Center, USA; Colton, M., NASA Marshall Space Flight Center, USA; Deblonde, G., NASA Marshall Space Flight Center, USA; Jedlovec, G., NASA Marshall Space Flight Center, USA; Lee, T., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 10th, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The American Meteorological Society held its Tenth Conference on Satellite Meteorology and Oceanography in conjunction with the 80th Annual Meeting in Long Beach, California. For the second consecutive conference, a format that consisted of primarily posters, complemented by invited theme oriented oral presentations, and panel discussions on various aspects on satellite remote sensing were utilized. Joint sessions were held with the Second Conference on Artificial Intelligence, the Eleventh Conference on Middle Atmosphere, and the Eleventh symposium on Global Change Studies. In total, there were 23 oral presentations, 170 poster presentations, and four panel discussions. Over 450 people representing a wide spectrum of the society attended one or more of the sessions in the five-day meeting. The program for the Tenth Conference on Satellite Meteorology and Oceanography can viewed in the October 1999 issue of the Bulletin.
Author
Conferences; Meteorological Satellites; Oceanography; Remote Sensing

20000073223 NASA Goddard Space Flight Center, Greenbelt, MD USA
Sensing Clouds via Spacecraft Radio Occultation Observations
Kursinski, E. R., Jet Propulsion Lab., California Inst. of Tech., USA; Wu, F., Wisconsin Univ., USA; Limaye, S., Wisconsin Univ., USA; Wu, M.– L., NASA Goddard Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The presence of clouds dramatically alters the opacity and radiative transfer within Earth's atmosphere at both short and long wavelengths. Knowledge of cloud top and base is needed to estimate the Outgoing Long wave Radiation (OLR) to space and the net radiation at the surface from a given atmospheric profile. Satellite observations are required to provide the global perspective needed for climate. Cloud top pressure can be determined to some accuracy from spaceborne radiance measurements when cloud opacities are sufficiently large and cloud top temperatures are sufficiently low to readily them from the surface. Cloud base is particularly difficult to determine from space. The relatively small sensitivity of long wavelengths must be used to penetrate the clouds while at the same time providing sufficient sensitivity to detect the cloud base. We are studying the indirect sensitivity of radio occultation observations to clouds through their impact on the refractivity structure. The tradewind inversion is an excellent example where a very sharp refractivity structure coincides with the top of the tradewind cumulus and stratus clouds. In general, any cloud with sufficient IR opacity will have large transmissivity gradient at cloud top (base) which will result in large cooling (heating) which will create a thermal inversion at cloud top (base). Both liquid and ice clouds can reach this critical opacity. The thermal inversion and sharp change in specific humidity will cause a sharp change in the refractivity gradient which can be identified in the radio occultation results, particularly the signal amplitude. The occultations yield very accurate information on the height of such features. The heating at cloud base drives convection causing the air to follow a moist adiabat within the Cloud which further helps constrain the interpretation of the observations. The upward expansion of such opaque clouds due to convection may be an important mechanism supplying moisture into the upper troposphere. We will present simulations using high resolution radiosondes from field campaigns representing the expected signatures of such features. We will also present initial results of comparisons between GPS observations and GOES-derived cloud tops to assess the utility of this concept.
Author
Clouds (Meteorology); Radio Occultation; Satellite Observation; Refractivity; Earth Atmosphere

20000073290 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Polarimetric Ku-Band Scatterometer for High Accuracy, Large Swath Global Wind Vector Measurements
Tsai, Wu–Yang, Jet Propulsion Lab., California Inst. of Tech., USA; Nghiem, Son V., Jet Propulsion Lab., California Inst. of Tech., USA; Huddleston, James, Jet Propulsion Lab., California Inst. of Tech., USA; Spencer, Michael, Jet Propulsion Lab., California Inst. of Tech., USA; Stiles, Bryan, Jet Propulsion Lab., California Inst. of Tech., USA; West, Richard, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

In the past, wind measurements from space using fan-beam antennas, such as Seasat Scatterometer (SASS-1), ERS-1 &2, and NASA scatterometer (NSCAT), required up to six large stick-like antennas and suffered a nadir gap of up to 400 km. In the near future, a spinning pencil-beam scatterometer system is to be used for the SeaWinds scatterometer on QuikSCAT (QSCAT) and on ADEOS-2 (SeaWinds). This scatterometer, though offering wind measurements in the nadir region, still suffers from degraded performance in the nadir and outer swath. The purpose of this paper is to present an advanced polarimetric spinning pencil-beam scatterometer system, which can significantly improve the wind performance across the entire swath. The polarimetric scatterometer simultaneously measures co-polarized backscatter and the polarimetric correlation of co- and cross-polarized radar returns from the ocean surface. The advantage over the conventional scatterometer system is that, while the co-polarization radar returns are even function of the wind direction, the polarimetric correlation is an odd function of wind direction due to the reflection symmetry of the wind roughened surface. Therefore, this polarimetric scatterometer system can provide additional, equivalent measurements at azimuth angle 45degree away from the corresponding co-polarization measurements. The combined co-polarization and correlation measurements enable good wind performance across the whole swath to be obtained. In this paper, we will first present the theoretical formulation of all of the key components required for designing a polarimetric scatterometer. Then, we show that good wind performance can be achieved by a slight improvement in the signal-to-noise ratio of the current QSCAT/SeaWinds design. We then present the predicated wind performance using computer simulation based on a model function for the co-polarized backscatter obtained from actual spaceborne scatterometer data and an estimated model function for the polarimetric correlation based on the asymmetry observed in backscatter data. Finally, we will show that, aside from ocean applications, this polarimetric scatterometer can also be used for ice and land applications.
Author

Computerized Simulation; Polarimetry; Satellite-Borne Instruments; Scatterometers; Wind Direction; Wind Measurement

20000073737 Environmental Protection Agency, National Exposure Research Lab., Research Triangle Park, NC USA
Application of a New Land-Surface, Dry Deposition, and PBL Model in the Models-3 Community Multi-Scale Air Quality (CMAQ) Model System
Pleim, J. E.; Byun, D. W.; 2000; 12p; In English
Like most air quality modeling systems, CMAQ divides the treatment of meteorological and chemical/transport processes into separate sequentially. A potential drawback to this approach is that it creates the illusion that these processes are minimally interdependent and that any meteorology model with a good reputation is adequate for air quality work. However, most mesoscale meteorology models are developed for operational weather forecasting and meteorological research. These foci do not emphasize all the same critical capabilities as air quality applications. Conversely, CTMs are often developed to accept basic meteorology inputs from a variety of sources with little regard to its quality and even less regard to consistency between physical parameterizations in the meteorology model and the CTM. The work reported here attempts to address some of these weak links in the system, particularly where improvements in land-surface modeling in the meteorology model and consistency with similar components in the CTM can have significant effects on the air quality simulation. Therefore, this development cuts across several system components. A new land-surface model (LSM), which features explicit simulation of soil moisture and vegetative evapotranspiration, has been coupled with the Fifth Generation Penn State/NCAR Mesoscale Model (MM5). An attendant dry deposition model has been developed to take advantage of the more sophisticated treatment of surface fluxes, stomatal conductance, and surface layer diffusion in the new LSM. The Meteorology Chemistry Interface Processer (MCIP) has been modified to include the new dry deposition model as well as to make the additional information resulting from the new LSM available to the CTM. Also, a new non-local closure PBL scheme that is compatible with the modifications made to the MM5 has been added to the list of vertical diffusion module options of the CMAQ CTM.
NTIS

Earth Surface; Deposition; Air Quality; Environment Models; Meteorology; Atmospheric Models

20000073792 Clarkson Univ., Potsdam, NY USA
Experiments With an Adapative Multigrid Shallow-Water Tropical Cyclone Model
Mitchell, Brittany L.; Fulton, Scott R.; May 2000; 2p; In English
Accurate modeling of tropical cyclone motion and in. tensity change requires resolving the flow both within and around the storm. Since the spatial scales in these two regions differ substantially, uniform resolution is inherently inefficient: the grid should be refined only near the storm. This idea motivates conventional nested-grid methods such as used in VlCBAR (DeMaria et al., 1992) and the GFDL model (Kurihara et al., 1998). Adaptive multigrid methods also achieve nonuniform resolution by superim-

posing uniform grids of different mesh sizes, but they combine this idea with multigrid processing (Brandt, 1977) to achieve optimum solution speed and provide accurate truncation error estimates. The latter can be used in an adaptive mesh refinement scheme to provide just the resolution needed at each point. The MUDBAR model of Fulton (2000) demonstrates the potential of adaptive multigrid methods in the context of a nondivergent barotropic model. We now consider the extension of these techniques to the next level of dynamical complexity, i.e., the shallow-water equations.
DTIC
Tropical Storms; Shallow Water; Multigrid Methods; Cyclones; Barotropism; Atmospheric Models

20000073793 Clarkson Univ., Potsdam, NY USA
Experiments With a Self-Adaptive Multigrid Barotropic Tropical Cyclone Track Model
Fulton, Scott R.; Burgess, Nicole M.; Mitchell, Brittany L.; Jan. 1999; 2p; In English
Contract(s)/Grant(s): N00014-98-1-0103; N00014-98-1-0368
Report No.(s): AD-A376800; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
     Accurate prediction of hurricane tracks may require resolving the flow both within and around the storm. Since the spatial scales in these two regions differ substantially, uniform resolution is inherently inefficient: the grid should be refined only near the storm. This paper describes the performance of a barotropic model with an adaptive multi-grid scheme which automatically refines the mesh around the storm as it moves. The model is formulatedl on a section of the sphere using a Mercator projection. The model consists of a modified barotropic vorticity equation.
DTIC
Cyclones; Hurricanes; Tropical Storms; Atmospheric Models; Barotropism

20000073808 Forschungszentrum Geesthacht G.m.b.H., Germany
Clouds over the marginal ice zone in the Arctics
Jankiewicz, P.; Hupfer, P.; Raschke, E.; Dec. 31, 1998; 108p; In German; In English
Report No.(s): DE99-715927; GKSS-98/E/3; No Copyright; Avail: Department of Energy Information Bridge
     Since clouds modulate dominantly the energy exchange between the atmosphere and the sea and sea-ice areas in the polar regions, they need particular attention in the climate modelling and measurement. Clouds, however are also the product of such intensive exchange processes. In order to understand them more accurately a numerical mode has ben used to study the exchanges near the marginal ice zone, where in these simulations the area was partly covered by open sea and partly by a closed ice deck. This work describes in some detail the cloud climatology over the Arctics, as far it could be determined on the basis of satellite and ground based observations. Then the mesoscale model GESIMA, which was developed at GKSS, is used for some simulations considering in particular the effects of the wind, of the ground albedo but also of different radiative transfer schemes.
NTIS
Sea Ice; Climatology; Cloud Cover

20000074100 NASA Marshall Space Flight Center, Huntsville, AL USA
Global Lightning Variations Caused by Changes in Thunderstorm Flash Rate and by Changes in Number of Thunderstorms
Williams, E. K., NASA Marshall Space Flight Center, USA; Rothkin, K., NASA Marshall Space Flight Center, USA; Stevenson, D., NASA Marshall Space Flight Center, USA; Boccippio, D., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only
     Global lightning activity is highly variable on many time scales. This variability is attributable to changes in the flash rate per thunderstorm, the number of thunderstorms, or a combination. The TRMM Mission offers lightning observations from the Optical Transient Detector (OTD) and the Lightning Imaging Sensor (LIS) in space. Both are used to examine the response of these parameters to thermodynamic forcing of deep convection on the diurnal and annual time scales. On both time scales, the changes in the number of storms dominate the variations in total lightning activity. On the diurnal time scale, the mean flash rate appears to vary with cloud buoyancy, peaking in early afternoon and declining in late afternoon, but the contribution of number of thunderstorms is 2-3 times greater that the mean storm flash rate. On the annual time scale, almost all of the total lightning response is due to changes in the number of storms, with a negligible contribution from flash rate. Evidence is presented that the LIS/OTD 'area' is a meaningful objective identifier for a thunderstorm.
Author
Diurnal Variations; Lightning; Thunderstorms; Atmospheric Electricity; Clouds (Meteorology)

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics, and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

20000068931 California Univ., San Diego, CA USA

A Satellite Study of the Biological Significance of Eddies in the Drake Passage and Western Scotia Sea

Chen, Xi, California Univ., USA; 1999; 54p; In English; Copyright; Avail: Issuing Activity

Phytoplankton biomass in pelagic waters of the Southern Ocean is generally low although there are high concentrations of major inorganic nutrients and favorable environmental conditions for phytoplankton growth. Synoptic maps of chlorophyll-alpha (chl-alpha) concentrations for the entire Southern Ocean collected by the SeaWiFS ocean color satellite reveal great spatial and temporal variability in chl-a concentrations during the austral spring and summer in pelagic Antarctic waters. While most of the pelagic waters south of the Polar Front (PF) have very low chl-alpha values, the Scotia Sea and waters north of the Ross Sea are considerably richer in phytoplankton throughout the entire summer period, Such high phytoplankton biomass must be supported by elevated fluxes of iron, which is now accepted to be the limiting nutrient for high nutrient, chlorophyll (HNLC) regions of the Southern Ocean. Satellite SST and chl-alpha data, surface drifter tracks and bottom bathymetry were studied in an attempt to better understand the physical mechanisms which may contribute to enhanced vertical or lateral transport of iron to enrich the waters east of the Drake Passage. Satellite imagery indicates several quasi-permanent eddy-like features in SST and chl-a that appear to be associated with significant bathymetry features in the Drake Passage. Surface drifter tracks show strong interaction with various bathymetry features. A combination of vertical mixing and lateral transport induced by the fluid flow interacting with the regional bathymetry are hypothesized to transport iron rich waters to the surface region of the western Scotia Sea leading to elevated phytoplankton biomass.

Author

Phytoplankton; Biomass; Pelagic Zone; Chlorophylls; Remote Sensing; Satellite Imagery

20000070364 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Modeling Mesoscale Eddies in the North Atlantic Ocean

Chao, Yi, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 10; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Ocean modeling plays an important role in understanding the current climatic conditions and predicting the future climate change. Modeling the ocean at eddy-permitting and/or eddy resolving resolutions (1/3 degree or higher) has a two-fold objective. One part is to represent the ocean as realistically as possible, because mesoscale eddies have an impact on the large-scale circulation. The second objective is to learn how to represent effects of mesoscale eddies without explicitly resolving them. This is particularly important for climate models which cannot be run at eddy-resolving resolutions because of the computational constraints. At JPL, a 1/6 degree latitude by 1/6 degree longitude with 37 vertical levels Atlantic Ocean model has been developed. The model is based on the Parallel Ocean Program (POP) developed at Los Alamos National Laboratory (LANL). Using the 256-processor Cray T3D, we have conducted a 40-year integration of this Atlantic eddy-resolving ocean model. A regional analysis demonstrate that many observed features associated with the Caribbean Sea eddies can be realistically simulated by this model. Analysis of this Atlantic eddy-resolving ocean model further suggests that these Caribbean Sea eddies are connected with eddies formed outside the Caribbean Sea at the confluence of the North Brazil Current (NBC) and the North Equatorial Countercurrent. The diagram of the model simulated surface current shows that the Caribbean eddies ultimately originate in the NBC retroflection region, traveling more than a year from the North Brazil coast through the Lesser Antilles into the Caribbean Sea and eventually into the Gulf of Mexico. Additional information is contained in the original.

Author

Climate Models; Mesoscale Phenomena; Ocean Models; Vortices; Atlantic Ocean; Air Water Interactions; Ocean Dynamics; Oceanography

20000070367 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Seasonal-to-Interannual Variability in Antarctic Sea-Ice Dynamics, and Its Impact on Surface Fluxes and Water Mass Production

Drinkwater, Mark R., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 13; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Strong seasonal and interannual signals in Antarctic bottom-water outflow remain unexplained yet are highly correlated with anomalies in net sea-ice growth in coastal polynyas. The mechanisms responsible for driving salination and replenishment and

rejuvenation of the dense shelf "source" waters likely also generate pulses of bottom water outflow. The objective of this research is to investigate time-scales of variability in the dynamics of sea-ice in the Southern Ocean in order to determine the primary sites for production of dense shelf waters. We are using a merged satellite/buoy sea-ice motion data set for the period 1978-present day to compute the dynamics of opening and closing of coastal polynyas over the continental shelf. The Ocean Circulation and Climate Advanced Model (OCCAM) ocean general circulation model with coupled sea-ice dynamics is presently forced using National Center for Environmental Prediction (NCEP) data to simulate fluxes and the salination impact of the ocean shelf regions. This work is relevant in the context of measuring the influence of polar sea-ice dynamics upon polar ocean characteristics, and thereby upon global thermohaline ocean circulation. Interannual variability in simulated net freezing rate in the Southern Weddell Sea is shown for the period 1986-1993. There is a pronounced maximum of ice production in 1988 and minimum in 1991 in response to anomalies in equatorward meridional wind velocity. This follows a similar approximate 8-year interannual cycle in Sea Surface Temperature (SST) and satellite-derived ice-edge anomalies reported elsewhere as the "Antarctic Circumpolar Wave." The amplitude of interannual fluctuations in annual net ice production are about 40% of the mean value, implying significant interannual variance in brine rejection and upper ocean heat loss. Southward anomalies in wind stress induce negative anomalies in open water production, which are observed in passive microwave satellite images. Thus, cycles of enhanced poleward wind stress reduce ice growth by compacting the ice along the coastline and closing open water in leads and polynyas. Model simulations confirm that years of low ice production, such as 1991, coincide with years of lower than normal bottom water outflow. Future plans include the assimilation of satellite ice concentrations and ice drift dynamics to more accurately constrain boundary conditions in the model.
Author
Antarctic Ocean; Antarctic Regions; Climate Models; Ocean Currents; Ocean Dynamics; Oceanography; Sea Ice; Sea Surface Temperature; Variability; Wind (Meteorology); Periodic Variations

20000070371 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Ocean Wave Studies with Applications to Ocean Modeling and Improvement of Satellite Altimeter Measurements
Glazman, Roman E., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 17; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Combining analysis of satellite data (altimeter, scatterometer, high-resolution visible and infrared images, etc.) with mathematical modeling of non-linear wave processes, we investigate various ocean wave fields (on scales from capillary to planetary), their role in ocean dynamics and turbulent transport (of heat and biogeochemical quantities), and their effects on satellite altimeter measuring accuracy. In 1998 my attention was focused on long internal gravity waves (10 to 1000 km), known also as baroclinic inertia-gravity (BIG) waves. We found these waves to be a major factor of altimeter measurements "noise," resulting in a greater uncertainty [up to 10 cm in terms of sea surface height (SSH) amplitude] in the measured SSH signal than that caused by the sea state bias variations (up to 5 cm or so). This effect still remains largely overlooked by the satellite altimeter community. Our studies of BIG waves address not only their influence on altimeter measurements but also their role in global ocean dynamics and in transport and turbulent diffusion of biogeochemical quantities. In particular, in collaboration with Prof Peter Weichman, Caltech, we developed a theory of turbulent diffusion caused by wave motions of most general nature. Applied to the problem of horizontal turbulent diffusion in the ocean, the theory yielded the effective diffusion coefficient as a function of BIG wave parameters obtainable from satellite altimeter data. This effort, begun in 1997, has been successfully completed in 1998. We also developed a theory that relates spatial fluctuations of scalar fields (such as sea surface temperature, chlorophyll concentration, drifting ice concentration, etc.) to statistical characteristics of BIG waves obtainable from altimeter measurements. A manuscript is in the final stages of preparation. In order to verify the theoretical predictions and apply them to observations, we are now analyzing Sea-viewing Wide Field of view Sensor (SeaWiFS) and Field of view Sensor (SeaWiFS) and Advanced Very High-Resolution Radiometer (AVHRR) data on sea surface temperature (SST) and chlorophyll concentration jointly with TOPEX/POSEIDON data on SSH variations.
Author
Baroclinity; Gravity Waves; Mathematical Models; Ocean Dynamics; Sea Surface Temperature; Water Waves

20000070375 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
El Nino and the Global Ocean Observing System
Halpern, David, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 21; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Until a decade ago, an often-quoted expression in oceanography is that very few observations are recorded throughout the ocean. Now, the sentiment is no longer valid in the uppermost 10% of the tropical Pacific Ocean nor at the surface of the global ocean. One of the remarkable legacies of the 1985-1994 Tropical Oceans Global Atmosphere (TOGA) Program is an in situ marine

meteorological and upper oceanographic measurement array throughout the equatorial Pacific to monitor the development and maintenance of El Nino episodes. The TOGA Observing System, which initially consisted of moored- and drifting-buoy arrays, a network of commercial ships, and coastal and island stations, now includes a constellation of satellites and data-assimilating models to simulate subsurface oceanographic conditions. The El Nino and La Nina tropical Pacific Ocean observing system represents the initial phase of an integrated global ocean observing system. Remarkable improvements have been made in ocean model simulation of subsurface currents, but some problems persist. For example, the simulation of the South Equatorial Current (SEC) remains an important challenge in the 2S-2N Pacific equatorial wave guide. During El Nino the SEC at the equator is reduced and sometimes the direction is reversed, becoming eastward. Both conditions allow warm water stored in the western Pacific to invade the eastern region, creating an El Nino episode. Assimilation of data is a tenet of faith to correct simulation errors caused by deficiencies in surface fluxes (especially wind stress) and parameterizations of subgrid-scale physical processes. In the first of two numerical experiments, the Pacific SEC was simulated with and without assimilation of subsurface temperature data. Along the equator, a very weak SEC occurred throughout the eastern Pacific, independent of assimilation of data. However, as displayed in the diagram, in the western Pacific there was no satisfactory agreement between the two simulations. to help determine reliability of the simulated SEC in the western Pacific, current measurements recorded during the 9-19 October 1994 voyage of the French research vessel L'Atalante are also shown in the diagram. With data assimilation, the simulated SEC was in much better agreement with L'Atalante observations. The simulated SEC with data assimilation was far from perfect, in part because of the sparsity of subsurface temperature observations. In the next experiment, TOPEX/POSEIDON sea surface height data in combination with subsurface temperatures will be assimilated to assess further improvement of the simulation of the SEC.
Author
El Nino; Marine Meteorology; Meteorological Parameters; Ocean Models; Oceanography; Tropical Meteorology; Ocean Temperature; Ocean Currents

20000070377 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Arctic Summer Ice Processes
Holt, Benjamin, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 23; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The primary objective of this study is to estimate the flux of heat and freshwater resulting from sea ice melt in the polar seas. The approach taken is to examine the decay of sea ice in the summer months primarily through the use of spaceborne Synthetic Aperture Radar (SAR) imagery. The improved understanding of the dynamics of the melt process can be usefully combined with ice thermodynamic and upper ocean models to form more complete models of ice melt. Models indicate that more heat is absorbed in the upper ocean when the ice cover is composed of smaller rather than larger floes and when there is more open water. Over the course of the summer, floes disintegrate by physical forcing and heating, melting into smaller and smaller sizes. by measuring the change in distribution of floes together with open water over a summer period, we can make estimates of the amount of heating by region and time. In a climatic sense, these studies are intended to improve the understanding of the Arctic heat budget which can then be eventually incorporated into improved global climate models. This work has two focus areas. The first is examining the detailed effect of storms on floe size and open water. A strong Arctic low pressure storm has been shown to loosen up the pack ice, increase the open water concentration well into the pack ice, and change the distribution of floes toward fewer and smaller floes. This suggests episodic melting and the increased importance of horizontal (lateral) melt during storms. The second focus area is related to an extensive ship-based experiment that recently took place in the Arctic called Surface Heat Budget of the Arctic (SHEBA). An icebreaker was placed purposely into the older pack ice north of Alaska in September 1997. The ship served as the base for experimenters who deployed extensive instrumentation to measure the atmosphere, ocean, and ice during a one-year period. My experiment will be to derive similar measurements (floe size, open water, temporal change) using spaceborne SAR data obtained during the summer of 1998, and compare these results with an ocean and ice model of summer melt. Additional information is contained in the original.
Author
Arctic Regions; Climate Models; Ice Floes; Ocean Models; Sea Ice; Water; Ice Mapping

20000070378 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Ice Flow in the Northeast Greenland Ice Stream
Joughin, Ian, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 24; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

As the use of satellite data for icesheet research has accelerated, new discoveries have changed the way that we think about ice discharge, and new tools have changed the way that we measure it. We have begun to apply a combination of remote sensing and ice sheet modeling techniques to study ice flow in the recently identified northeast Greenland ice stream. This ice stream shows

evidence of organized flow far into the interior and has low-slope areas of rapid flow and regions of enhanced shear that resemble the ice streams of West Antarctica. The onset of rapid flow close to the ice divide and the evolution of its flow pattern, however, make this ice stream unique. Our investigation is aimed at increasing our understanding of this ice stream and its origins and role in the discharge of ice from the ice sheet and the effects that discharge may have on the history and evolution of the ice in northern Greenland. The ice flow data comes from satellite radar interferometry tied to reference points. We have applied this technique to measure the velocity over the entire ice stream, which is more than 700 km in length. The velocity contours reveal distinct, well-developed shear margins, which are coincident with linear features in the Synthetic Aperture Radar (SAR) amplitude imagery. It is surprising to see such defined, enhanced flow so far inland and so close to the ice divide. The velocity data and topography data are being used to feed a modeling effort that allows us to study the dynamics and character rapid flow. Additional information is contained in the original.

Author

Flow Distribution; Greenland; Ice; Ice Floes; Arctic Ocean

20000070381 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Variability of Fram Strait Ice Flux and North Atlantic Oscillation

Kwok, Ron, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 27; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

An important term in the mass balance of the Arctic Ocean sea ice is the ice export. We estimated the winter sea ice export through the Fram Strait using ice motion from satellite passive microwave data and ice thickness data from moored upward looking sonars. The average winter area flux over the 18-year record (1978-1996) is 670,000 square km, approximately 7% of the area of the Arctic Ocean. The winter area flux ranges from a minimum of 450,000 sq. km in 1984 to a maximum of 906,000 sq km in 1995. The daily, monthly and interannual variabilities of the ice area flux are high. There is an upward trend in the ice area flux over the 18-year record. The average winter volume flux over the winters of October 1990 through May 1995 is 1745 cubic km ranging from a low of 1375 cubic km in 1990 to a high of 2791 cubic km in 1994. The sea-level pressure gradient across the Fram Strait explains more than 80% of the variance in the ice flux over the 18-year record. We use the coefficients from the regression of the time-series of area flux versus pressure gradient across the Fram Strait and ice thickness data to estimate the summer area and volume flux. The average 12-month area flux and volume flux are 919,000 sq km and 2366 cubic km. We find a significant correlation (R =0.86) between the area flux and positive phases of the North Atlantic Oscillation (NAO) index over the months of December through March. Correlation between our six years of volume flux estimates and the NAO index gives R =0.56. During the high NAO years, a more intense Icelandic low increases the gradient in the sea-level pressure by almost 1 mbar across the Fram Strait thus increasing the atmospheric forcing on ice transport. Correlation is reduced during the negative NAO years because of decreased dominance of this large-scale atmospheric pattern on the sea-level pressure gradient across the Fram Strait. Additional information is contained in the original.

Author

Arctic Ocean; Sea Ice; Sea Level; Ice Mapping; Atlantic Ocean

20000070382 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Data Assimilation Into a Coupled Ocean Atmosphere Model: Application to the 1997-1998 El Nino

Lee, Tong, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 28; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

As part of JPL's ocean data assimilation effort to study ocean circulation and seasonal-interannual climate variability, sea level anomaly observed by TOPEX altimeter, together with sea surface temperature and wind stress data, are assimilated into a simple coupled ocean atmosphere model of the tropical Pacific. Model-data consistency is examined. Impact of the assimilation (as initialization) on El Nino Southern Oscillation (ENSO) forecasts is evaluated. The coupled model consists of a shallow water component with two baroclinic modes, an Ekman shear layer, a simplified mixed-layer temperature equation, and a statistical atmosphere based on dominant correlations between historical surface temperature and wind stress anomaly data. The adjoins method is used to fit the coupled model to the data over various six-month periods from late 1996 to early 1998 by optimally adjusting the initial state, model parameters, and basis functions of the statistical atmosphere. On average, the coupled model can be fitted to the data to approximately within the data and representation errors (5 cm, 0.5 C, and 10 sq m/sq m for sea level, surface temperature, and pseudo wind stress anomalies, respectively). The estimated fields resemble observed spatio-temporal structure reasonably well. Hindcasts/forecasts of the 1997/1998 El Nino initialized from forced estimated ocean states and parameters are much more realistic than those simply initialized from ocean states (see figure below). In particular, the ability of the model to produce significant

warming beyond the initial state is dramatically improved. Parameter estimation, which compensates for some model errors, is found to be important to obtaining better fits of the model to data and to improving forecasts.
Author

Air Water Interactions; Atmospheric Models; El Nino; Ocean Currents; Pacific Ocean; Sea Level; Sea Surface Temperature; Wind (Meteorology); Ocean Models

20000070388 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Corals from Space

Patzert, William C., Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 34; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The goal of this research is to monitor the health and vigor of coral reef ecosystems, and their sensitivity to natural and anthropogenic climate changes. to achieve these lofty goals, this research is investigating the feasibility of using spaceborne high-resolution spectrometers (on the US LANDSAT, French Systeme Probatoire pour l'Observation de la Terre [SPOT] and/or the Indian Resources Satellite [IRS 1C & 1D] spacecraft) to first map the aerial extent of coral reef systems, and second separate the amount of particular corals. If this is successful, we could potentially provide a quantum leap in our understanding of coral reef systems, as well as provide much needed baseline data to measure future changes in global coral reef ecosystems. In collaboration with Tomas Tomascik, Yann Morel, and other colleagues, a series of experiments were planned to coordinate in situ coral observations, high-resolution spaceborne imagery (from LANDSAT, SPOT, and, possibly, IRS IC spacecraft), and NASA Space Shuttle photographs and digital images. Our eventual goal is to develop "coral health algorithms" that can be used to assess time series of imagery collected from satellite sensors (LANDSAT since 1972, SPOT since 1986) in concert with in situ observations. The bad news from last year was that from 1997 to mid- 1998, the extreme cloudiness over southeast Asia due to prolonged smoke from El Nino-related fires and the economic chaos in this region frustrated both our space and reef-based data collection activities. When this volatile situation stabilizes, we will restart these activities. The good news was that in collaboration with Al Strong at the National Oceanic and Atmospheric Administration (NOAA) we had an exciting year operationally using the NOAA's Advanced Very High Resolution Radiometer sensor derived sea surface temperature products to warn of coral "bleaching" at many locations throughout the tropics. Data from NOAA's satellites showed that during the El Nino of 1997 and the first half of 1998, more ocean area in the tropics experienced exceptionally high sea surface temperatures, or "hot spots," than have been observed in any fall year since the El Nino of 1982. From January to July, the coral bleaching events were concentrated in the Southern Hemisphere (during its warm season). Since July 1998, the reports of extensive coral bleaching have again spread into regions of the Northern Hemisphere following abnormally high sea surface temperatures, especially around the Philippines and throughout the Caribbean Basin, Bahamas, Bermuda and Florida Keys. These El Nino induced events clearly demonstrated that corals are the "canaries of the marine ecosystem," highly sensitive to short-term natural climate events (El Nino), and should be monitored as measures of longer-term environmental and climate change. Additional information is contained in the original.
Author

Bleaching; Climate Change; Coral Reefs; El Nino; Environment Effects; Man Environment Interactions; Sea Surface Temperature; Tropical Regions; Reefs; Satellite Observation

20000070389 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Use of Data to Improve El Nino Southern Oscillation Simulations and Forecasts

Perigaud, Claire, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 35; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Various data over the period 1980-1998 have been used to improve El Nino Southern Oscillation (ENSO) simulations and forecasts performed by coupled ocean/atmosphere models. For such a study, oceanic and atmospheric satellite data are necessary. Models assume a baroclinic ocean with a mixed layer coupled to a baroclinic atmosphere to simulate the anomalous fields. The various data have been used to revisit the parameterizations of the subsurface temperature in the mixed layer, atmospheric convection, and friction in the baroclinic ocean. This new model, named Tsub.Conv, simulates 4-year oscillations like the model with the original parameterization, but with anomalous thermocline and wind anomalies that agree a lot better with reality. The atmospheric model still presents some deficiencies in the eastern Pacific and when it is replaced by a statistical atmosphere, the coupled model (Tsub.Astat) performs even better. It is found that the off-equatorial ocean and wind curl anomalies play a crucial role for all these models and that Tsub.Astat simulates an ocean heat content recharge coming from the north prior to a warm event like the ones observed during the 1985-1992 period. The ENSO forecasts over 1980-1998 are considerably improved with Tsub.Astat.

One needs to add the simulation of westerly wind bursts to be able to forecast the 1997 event one year in advance. Additional information is contained in the original.

Author

Air Water Interactions; Atmospheric Models; El Nino; Mathematical Models; Simulation; Southern Oscillation; Weather Forecasting; Wind (Meteorology)

20000070390 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Radar Interferometry Studies of the Mass Balance of Polar Ice Sheets

Rignot, Eric, Editor, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 36; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The objectives of this work are to determine the current state of mass balance of the Greenland and Antarctic Ice Sheets. Our approach combines different techniques, which include satellite synthetic-aperture radar interferometry (InSAR), radar and laser altimetry, radar ice sounding, and finite-element modeling. In Greenland, we found that 3.5 times more ice flows out of the northern part of the Greenland Ice Sheet than previously accounted for. The discrepancy between current and past estimates is explained by extensive basal melting of the glacier floating sections in the proximity of the grounding line where the glacier detaches from its bed and becomes afloat in the ocean. The inferred basal melt rates are very large, which means that the glaciers are very sensitive to changes in ocean conditions. Currently, it appears that the northern Greenland glaciers discharge more ice than is being accumulated in the deep interior, and hence are thinning. Studies of temporal changes in grounding line position using InSAR confirm the state of retreat of northern glaciers and suggest that thinning is concentrated at the lower elevations. Ongoing work along the coast of East Greenland reveals an even larger mass deficit for eastern Greenland glaciers, with thinning affecting the deep interior of the ice sheet. In Antarctica, we found that glaciers flowing into a large ice shelf system, such as the Ronne Ice Shelf in the Weddell Sea, exhibit an ice discharge in remarkable agreement with mass accumulation in the interior, and the glacier grounding line positions do not migrate with time. Glaciers flowing rapidly into the Amudsen Sea, unrestrained by a major ice shelf, are in contrast discharging more ice than required to maintain a state of mass balance and are thinning quite rapidly near the coast. The grounding line of Pine Island glacier (see diagram) retreated 5 km in 4 years, which corresponds to a glacier thinning rate of 3.5 m/yr. Mass imbalance is even more negative on Thwaites Glacier. This sector of West Antarctica probably initiated its collapse decades or centuries ago, once the embaying ice shelves in front of them started to melt because of enhanced basal melting from warmer ocean waters. Additional information is contained in the original.

Author

Antarctic Regions; Glaciers; Greenland; Land Ice; Mass Distribution; Polar Caps; Ocean Temperature

20000070393 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Measuring Greenland Ice Mass Variation With Gravity Recovery and the Climate Experiment Gravity and GPS

Wu, Xiao–Ping, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 39; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The response of the Greenland ice sheet to climate change could significantly alter sea level. The ice sheet was much thicker at the last glacial maximum. to gain insight into the global change process and the future trend, it is important to evaluate the ice mass variation as a function of time and space. The Gravity Recovery and Climate Experiment (GRACE) mission to fly in 2001 for 5 years will measure gravity changes associated with the current ice variation and the solid earth's response to past variations. Our objective is to assess the separability of different change sources, accuracy and resolution in the mass variation determination by the new gravity data and possible Global Positioning System (GPS) bedrock uplift measurements. We use a reference parameter state that follows a dynamic ice model for current mass variation and a variant of the Tushingham and Peltier ICE-3G deglaciation model for historical deglaciation. The current linear trend is also assumed to have started 5 kyr ago. The Earth model is fixed as preliminary reference Earth model (PREM) with four viscoelastic layers. A discrete Bayesian inverse algorithm is developed employing an isotropic Gaussian a priori covariance function over the ice sheet and time. We use data noise predicted by the University of Texas and JPL for major GRACE error sources. A 2 mm/yr uplift uncertainty is assumed for GPS occupation time of 5 years. We then carry out covariance analysis and inverse simulation using GRACE geoid coefficients up to degree 180 in conjunction with a number of GPS uplift rates. Present-day ice mass variation and historical deglaciation are solved simultaneously over 146 grids of roughly 110 km x 110 km and with 6 time increments of 3 kyr each, along with a common starting epoch of the current trend. For present-day ice thickness change, the covariance analysis using GRACE geoid data alone results in a root mean square (RMS) posterior root variance of 2.6 cm/yr, with fairly large a priori uncertainties in the parameters and a Gaussian correlation length of 350 km. Simulated inverse can successfully recover most features in the reference present-day change. The RMS difference between them over the grids is 2.8 cm/yr. The RMS difference becomes 1.1 cm/yr when both are averaged with a half Gaussian wavelength of 150 km. With a fixed Earth model, GRACE alone can separate the geoid signals due to past and

current load fairly well. Shown are the reference geoid signatures of direct and elastic effects of the current trend, the viscoelastic effect of the same trend starting from 5 kyr ago, the Post Glacial Rebound (PGR), and the predicted GRACE geoid error. The difference between the reference and inverse modeled total viscoelastic signatures is also shown. Although past and current ice mass variations are allowed the same spatial scale, their geoid signals have different spatial patterns. GPS data can contribute to the ice mass determination as well. Additional information is contained in the original.
Author
Dynamic Models; Glaciers; Glaciology; Global Positioning System; Greenland; Ice; Climate Models

20000070394 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Detecting 1mm/Year Signals in Altimetric Global Sea Level: Effect of Atmospheric Water Vapor and Precipitation
Zlotnicki, Victor, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 40; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Several research efforts exist to use Topography Experiment (TOPEX)/ Projet d'Observatorie de Surveillance et d'Etudes Integrees de la Dynamique des Oceans (Poseidon) (T/P) to detect changes in global sea level possibly associated with climate change. This requires much better than 1 mm/yr accuracy, something that none of the instruments in T/P [or the European Remote Sensing (ERS-2) satellite, or the U.S. Navy's Geosat Follow-On (GFO) satellite] were designed for. This work focuses on the ability of the T/P microwave radiometer (TMR) to retrieve the path delay due to atmospheric water vapor along the altimeter's path with accuracy in the time changes below 1 mm/yr on global average. In collaboration with Stephen Keihm of JPL and Christopher Ruf of Pennsylvania State University, we compared TMR path delay (PD) estimates with atmospheric precipitable water (PW) from the Special Sensor Microwave Imager (SSMI) aboard the Defense Meteorological Satellite Program (DMSP) series of satellites for 1992-1998 to selected radiosondes, and we also looked at the brightness temperatures measured by TMR in the lowest 1% of the histogram. The conclusion is that TMR had a slow instrumental drift, associated with the 18-GHz channel, which causes an approximate underestimation of water vapor at a rate equivalent to 1.2 mm/yr in path delay between 1992 and 1996; this effect stopped and no drift is detected in 1997. The same study concluded that there is no detectable scale error (one which is proportional to measured vapor) in TMR. In related work, carried out with graduate student Damien Cailliau, we investigated the relative abilities of TMR, SSMI and the UP dual-frequency radar altimeter to detect rain, relative to a climatology of shipborne observations. Rain is a crucial but poorly measured variable in studies of the climate system, and a dedicated mission, Tropical Rainfall Measuring Mission (TRMM), was recently launched to measure it. However, the climatologies built over the past 10 years used passive radiometers, such as SSMI, or infrared observation from National Oceanic and Atmospheric Administration (NOAA) geostationary satellites. We concluded that the dual-frequency altimeter does an excellent job at retrieving rain on scales much smaller than the passive radiometer, and a better job at retrieving total precipitation (rain as well as snow) at high latitudes. This work improves the sea level observations by allowing better flagging of observations contaminated by rain, and more importantly, provides an alternative way to measure rainfall over the oceans.
Author
Rain; Sea Level; Seas; Water Vapor; Sea States; Satellite Observation; Ocean Surface

20000070661 Hawaii Univ., School of Ocean and Earth Science and Technology, Honolulu, HI USA
Refraction and Diffraction of Nonlinear Waves: Green-Naghdi Equations
Sundararaghavan, H., Hawaii Univ., USA; Ertekin, R. C., Hawaii Univ., USA; Dec. 1999; 90p; In English
Report No.(s): PB2000-105914; OE-UHMOE-99-207; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The Green-Naghdi equations are shallow water equations which can be solved to predict the nonlinear-effects of water waves propagating in shallow waters. In this study, we derive the Green-Naghdi equations for variable bathymetry and formulate the numerical model as a boundary-value problem. A finite-difference model, in conjunction wit grid-generation, is developed to solve the Green-Naghdi equations. Non-linear wave propagation over a varying bathymetry is presented for solitary and cnoidal waves.
NTIS
Bathymeters; Finite Difference Theory; Flow Equations; Shallow Water; Wave Propagation; Diffraction; Water Waves; Boundary Value Problems

20000070723 NASA Goddard Space Flight Center, Greenbelt, MD USA
Modeling of Dense Water Production and Salt Transport from Alaskan Coastal Polynyas
Signorini, Sergio R., General Sciences Corp., USA; Cavalieri, Donald J., NASA Goddard Space Flight Center, USA; [2000]; 35p; In English
Contract(s)/Grant(s): N00014-98-C-0022-MOD-P00003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The main significance of this paper is that a realistic, three-dimensional, high-resolution primitive equation model has been developed to study the effects of dense water formation in Arctic coastal polynyas. The model includes realistic ambient stratification, realistic bottom topography, and is forced by time-variant surface heat flux, surface salt flux, and time-dependent coastal flow. The salt and heat fluxes, and the surface ice drift, are derived from satellite observations (SSM/I and NSCAT sensors). The model is used to study the stratification, salt transport, and circulation in the vicinity of Barrow Canyon during the 1996/97 winter season. The coastal flow (Alaska coastal current), which is an extension of the Bering Sea throughflow, is formulated in the model using the wind-transport regression. The results show that for the 1996/97 winter the northeastward coastal current exports 13% to 26% of the salt produced by coastal polynyas upstream of Barrow Canyon in 20 to 30 days. The salt export occurs more rapidly during less persistent polynyas. The inclusion of ice-water stress in the model makes the coastal current slightly weaker and much wider due to the combined effects of surface drag and offshore Ekman transport.
Author
Heat Flux; High Resolution; Mathematical Models; Microwave Imagery; Primitive Equations; Scatterometers; Three Dimensional Models; Water; Density (Mass/Volume); Circulation

20000072433 NASA Goddard Space Flight Center, Greenbelt, MD USA
Seven-Year SSM/I-Derived Global Ocean Surface Turbulent Fluxes
Chou, Shu–Hsien, NASA Goddard Space Flight Center, USA; Shie, Chung–Lin, Science Systems and Applications, Inc., USA; Atlas, Robert M., NASA Goddard Space Flight Center, USA; Ardizzone, Joe, General Sciences Corp., USA; [June 2000]; 41p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A 7.5-year (July 1987-December 1994) dataset of daily surface specific humidity and turbulent fluxes (momentum, latent heat, and sensible heat) over global oceans has been retrieved from the Special Sensor Microwave/Imager (SSM/I) data and other data. It has a spatial resolution of 2.0 deg.x 2.5 deg. latitude-longitude. The retrieved surface specific humidity is generally accurate over global oceans as validated against the collocated radiosonde observations. The retrieved daily wind stresses and latent heat fluxes show useful accuracy as verified by those measured by the RV Moana Wave and IMET buoy in the western equatorial Pacific. The derived turbulent fluxes and input variables are also found to agree generally with the global distributions of annual-and seasonal-means of those based on 4-year (1990-93) comprehensive ocean-atmosphere data set (COADS) with adjustment in wind speeds and other climatological studies. The COADS has collected the most complete surface marine observations, mainly from merchant ships. However, ship measurements generally have poor accuracy, and variable spatial coverages. Significant differences between the retrieved and COADS-based are found in some areas of the tropical and southern extratropical oceans, reflecting the paucity of ship observations outside the northern extratropical oceans. Averaged over the global oceans, the retrieved wind stress is smaller but the latent heat flux is larger than those based on COADS. The former is suggested to be mainly due to overestimation of the adjusted ship-estimated wind speeds (depending on sea states), while the latter is suggested to be mainly due to overestimation of ship-measured dew point temperatures. The study suggests that the SSM/I-derived turbulent fluxes can be used for climate studies and coupled model validations.
Author
Microwave Imagery; Ocean Surface; Remote Sensing; Turbulence; Heat Flux; Annual Variations; Climatology

20000073299 NASA Goddard Space Flight Center, Greenbelt, MD USA
Salinity Measurements During the Gulf Stream Experiment
LeVine, D. M., NASA Goddard Space Flight Center, USA; Koblinsky, C., NASA Goddard Space Flight Center, USA; Howden, S., NASA Goddard Space Flight Center, USA; Goodberlet, M., Quadrant Engineering, Inc., USA; [2000]; 1p; In English; Geoscience and Remote Sensing, 24-28 Jul. 2000, Honolulu, HI, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The salinity of the open ocean is important for understanding ocean circulation, for understanding energy exchange with the atmosphere and for improving models to predict weather and climate. Passive microwave sensors at L-band (1.4 GHz) operating from aircraft have demonstrated that salinity can be measured with sufficient accuracy (1 psu) to be scientifically meaningful in coastal waters. However, measuring salinity in the open ocean presents unresolved issues largely because of the much greater accuracy (approx. 0.1 psu) required to be scientifically viable. In the summer of 1999 a series of measurements called, The Gulf Stream Experiment, were conducted as part of research at the Goddard Space Flight Center to test the potential for passive microwave remote sensing of salinity in the open ocean. The measurements consisted of a compliment of airborne microwave instruments (radiometers and scatterometer) and ships and drifters for surface truth. The study area was a 200 km by 100 km rectangle about 250 km east of Delaware Bay between the continental shelf waters and north wall of the Gulf Stream. The primary passive instruments were the ESTAR radiometer (L-band, H-pol) and the SLFMR radiometer (L-band, V-pol). In addition, the compliment of instruments on the aircraft included a C-band radiometer (ACMR), an ocean wave scatterometer (ROWS) and an infrared radiometer. A GPS backscatter experiment was also part of the package. These instruments were mounted on the NASA P-3 Orion

aircraft. Surface salinity measurements were provided by the RN Cape Henlopen and MN Oleander (thermosalinographs) plus salinity and temperature sensors on three surface drifters deployed from the RN Cape Henopen. The primary experiment period was August 26-September 2, 1999. During this period the salinity field within the study area consisted of a gradient on the order of 2-3 psu in the vicinity of the shelf break and a warm core ring with a gradient of 1-2 psu. Detailed maps were made with the airborne sensors on August 28 and 29 and on September 2 flights were made over the surface drifters to look for effects due to a change in surface roughness resulting from the passage of Hurricane Dennis. Preliminary results show a good agreement between the microwave measurements and ship measurements of salinity. The features of the brightness temperature maps correspond well with the features of the salinity field measured by the ship and drifters and a preliminary retrieval of salinity compares well with the ship data.
Author
Salinity; Climate; Oceans; Atmospheric Models; Microwave Sensors; Infrared Radiometers; Ultrahigh Frequencies

20000073807 Forschungszentrum Geesthacht G.m.b.H., Germany
Wave climate of the Northeast Atlantic over the period 1955-1994: the WASA wave hindcast
Guenther, H.; Rosenthal, W.; Stawarz, M.; Carretero, J. C.; Gomez, M.; Dec. 31, 1997; 37p; In English
Report No.(s): DE99-715928; GKSS-97/E/73; No Copyright; Avail: Department of Energy Information Bridge
    The European project 'waves and storms in the North Atlantic' (WASA) has been set up to prove, or to disprove, hypotheses of a worsening storm and wave climate in the Northeast Atlantic and adjacent seas in this century. Changes in the wave climate were assessed with a state-of-the-art wave model using wind analyses. Within the scope of the WASA project, a 40 year reconstruction (1955-1994) of the wave climate in the North Atlantic was completed using the WAM wave model. The input wind fields were assumed to be reasonably homogeneous with time in the area south of 70 N and east of 20 W, and it was expected that the hindcast wave data would reliably describe the space-time evolution of wave conditions in this area. The results of the hindcast experiment are presented in this article. The main conclusion was that the wave climate in most of the Northeast Atlantic and in the North Sea has undergone significant variations on time scales of decades. Part of variability was found to be related to the North Atlantic oscillation. In general, we noted an increase of the maximum annual significant wave height over the last 40 years of about 5 to 10 cm/year for large parts of the Northeast Atlantic, north of the North Sea. There was also a slight increase of probabilities of high waves derived from conventional extreme value statistics in northwest approaches to the North Sea. Similar trends of the extreme waves were found in a scenario of future wave climate at a time of doubled CO_2 concentration in the atmosphere.
NTIS
Climate; Storms; Water Waves; Climate Change

20000073809 Forschungszentrum Geesthacht G.m.b.H., Germany
Changing waves and storms in the Northeast Atlantic
Carretero, J. C.; Gomez, M.; Lozano, I.; Dec. 31, 1997; 28p; In English
Report No.(s): DE99-715841; GKSS-97/E/46; No Copyright; Avail: Department of Energy Information Bridge
    The European project WASA has been set up to verifying, or to disprove hypotheses of a worsening storm and wave climate in the Northeast Atlantic and its adjacent seas in the present century. Its main conclusion is that the storm- and wave climate in most of the Northeast Atlantic and in the North Sea has undergone significant variations on time scales of decades; it has indeed roughened in recent decades, but the present intensity of the storm- and wave- climate seems to be comparable with that at the beginning of this century. Part of this variability is found to be related to the North Atlantic oscillation. An analysis of a high-resolution climate change experiment, mimicking global warming due to increased greenhouse gas concentrations, results in a weak increase of storm activity and (extreme) wave heights in the Bay of Biscay and in the North Sea, while storm action and waves slightly decrease along the Norwegian coast and in most of the remaining North Atlantic area. A weak increase in storm surges in the southern and eastern part of the North Sea is expected. These projected anthropogenic changes at the time of CO_2 doubling fall well within the limits of variability observed in the past. A major methodical obstacle for the assessment of changes in the intensity of storm and wave events are inhomogeneities in the observational record, both in terms of local observations and of analyzed pro ducts (such as weather maps), which usually produce an artificial increase of extreme winds. This occurs because older analyses were based on fewer observations and with more limited conceptual and numerical models of the dynamical processes than more recent analyses.
NTIS
Storms; Climate Change

Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Satellite Altimetry for a Global Ocean Observing System

Fu, Lee–Lueng, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Space-age technologies have made satellite remote sensing a powerful new tool to study the Earth on a global scale. However, the opacity of the ocean to electromagnetic sensing has limited spaceborne measurements to the properties of the surface layer of the ocean (such as sea surface temperature and color). The radar altimetric measurement of the height of the sea surface relative to the geoid, the dynamic topography of the ocean, is a very useful quantity for studying the circulation of the ocean. The ability of measuring dynamic topography from space makes satellite altimetry a uniquely useful remote sensing technique because dynamic topography reflects oceanic processes not only at the surface but at depths as well. A simple analysis shows that a one centimeter tilt in the dynamic topography is associated with a mass transport of 1-7 Sv (1Sv= 1 million tons per second) in the open ocean depending on the vertical distribution of current velocity. Such a magnitude is an appreciable fraction of the transport of the Florida Current (circa 30 Sv), for instance. TOPEX/POSEIDON has demonstrated the capability of measuring the time variation of sea level with accuracy approaching to 2 cm when the data are averaged over boxes with several hundred kilometers on each side. The data set has been used for studying ocean circulation phenomena with a wide range of scales, ranging from fast-changing barotropic variability to seasonal and interannual variability such as El Nino and La Nina. The long record of precise measurement of global sea level has also showed great promise for monitoring the variation of mean sea level, an effective indi-cator of global climate change. Continuation of satellite altimetry missions with capability matching or better than that of TOPEX/POSEIDON should be included as a key component of a Global Ocean Observing System. NASA and CNES have committed to continuing the measurement of TOPEX/POSEIDON with a series of follow-on missions called Jason. The first of the series, Jason-1, is scheduled for launch in May, 2000. Such a series of missions will provide a key data stream for both research and prac-tical applications and benefit the objectives of global programs such as CLIVAR and GODAE.
Author

Remote Sensing; Satellite Altimetry; Oceanography; Satellite Observation

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non–human); ecology; microbiology; and also the origin, development, struc-ture, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.

NASA Marshall Space Flight Center, Huntsville, AL USA

Effect of Electrical Stimulation on Beta-Adrenergic Receptor Population and Cyclic AMP Production in Chicken and Rat Skeletal Muscle Cell Cultures

Young, Ronald B., NASA Marshall Space Flight Center, USA; Bridge, Kristin Y., NASA Marshall Space Flight Center, USA; Strietzel, Catherine J., Alabama Univ., USA; In Vitro Cellular and Development Biology - Animal; March 2000; ISSN 1071-2690; Volume 36, pp. 167-173; In English

Contract(s)/Grant(s): NIH-AR-42719; Copyright; Avail: Issuing Activity

Expression of the beta-adrenergic receptor (PAR) and its coupling to Adenosine 3'5' Cyclic Monophosphate (cAMP) synthesis are important components of the signaling system that controls muscle atrophy and hypertrophy and the goal of this study was to determine if electrical stimulation in a pattern simulating slow muscle contraction would alter the PAR response in primary cultures of avian and mammalian skeletal muscle cells. Specifically chicken skeletal muscle cells and rat skeletal muscle cells that had been grown for 7 d in culture, were subjected to electrical stimulation for an additional 2 d at a pulse frequency of 0.5 pulses/sec and a pulse duration of 200 msec. In chicken skeletal muscle cells, the PAR population was not significantly affected by electrical stimulation; however, the ability, of these cells to synthesize cyclic AMP was reduced by approximately one-half. In contrast, the PAR population in rat muscle cells was increased slightly but not significantly by electrical stimulation, and the ability of these cells to synthesize cyclic AMP was increased by almost twofold. The basal levels of intracellular cyclic AMP in neither rat muscle cells nor chicken muscle cells were affected by electrical stimulation.
Author

Adrenergics; Chickens; Musculoskeletal System; Rats; Culture Techniques; Cells (Biology); Electric Stimuli; Cyclic Amp

20000068516 Bionetics Corp., Moffett Field, CA USA

Mineral Nutrition of Plants, Chapter 9

Wignarajah, Kanapathipillai, Bionetics Corp., USA; Handbook of Plant and Crop Physiology; [1995], pp. 193-221; In English; Copyright; Avail: Issuing Activity

The ultimate source of nutrients for all living organisms consists of the inanimate nutrient reserves found on earth. of the elements known to exist, seven are considered essential to plants in large amounts (macronutrients), and many others are required in smaller quantities (micronutrients). Essentiality of a nutrient is defined according to the following concepts: (a) A deficiency of the element makes it impossible for the plant to complete the vegetative or reproductive stage of its cycle; (b) such deficiency is specific to the element in question and can be prevented or corrected only by supplying this element; (c) the element is directly involved in the nutrition of the plant quite apart from its possible effects in correcting some unfavorable microbiological or chemical condition of the soil or other culture medium. From that standpoint a favorable response from adding a given element to the culture medium does not constitute conclusive evidence of its indispensability in plant nutrition. All the elements occurring in the outer part of the earth are in constant turnover among the different components of earth. This overall migration is referred to as geochemical cycling. When cycling includes a role for biological organisms, it is referred to as "biogeochemical cycling." Like most cyclical processes in nature, the biogeochemical cycling of elements is not continuous, nor does it proceed in a well-defined direction. At stages, it may be halted or short-circuited, or it may change. Any changes will eventually impact the survival, evolution, and development of biological species in the system. The relationship of the various systems is represented in a schematic manner. To assess the efficiency of operation of the biogeochemical cycles, it is important to include both natural and human activities. Often reliable values on use by man are difficult to obtain for a number of reasons, such as lack of international cooperation, and lack of proper bookkeeping and auditing by individual nations. However, a general estimate of the annual world consumption of elements and their compounds is presented.

Derived from text

Minerals; Organisms; Nutrition; Biogeochemistry; Plants (Botany)

20000069788 NASA Ames Research Center, Moffett Field, CA USA

Metabolic Cages for a Space Flight Model in the Rat

Harper, Jennifer S., NASA Ames Research Center, USA; Mulenburg, Gerald M., NASA Ames Research Center, USA; Evans, Juli, NASA Ames Research Center, USA; Navidi, Meena, NASA Ames Research Center, USA; Wolinsky, Ira, Houston Univ., USA; Arnaud, Sara B., NASA Ames Research Center, USA; Laboratory Animal Science; December 1994, pp. 645-647; In English

Contract(s)/Grant(s): RTOP 199-26-12-02; Copyright; Avail: Issuing Activity

A variety of space flight models are available to mimic the physiologic changes seen in the rat during weightlessness. The model reported by Wronski and Morey-Holton has been widely used by many investigators, in musculoskeletal physiologic studies especially, resulting in accumulation of an extensive database that enables scientists to mimic space flight effects in the 1-g environment of Earth. However, information on nutrition or gastrointestinal and renal function in this space flight model is limited by the difficulty in acquiring uncontaminated metabolic specimens for analysis. In the Holton system, a traction tape harness is applied to the tail, and the rat's hindquarters are elevated by attaching the harness to a pulley system. Weight-bearing hind limbs are unloaded, and there is a headward fluid shift. The tail-suspended rats are able to move freely about their cages on their forelimbs and tolerate this procedure with minimal signs of stress. The cage used in Holton's model is basically a clear acrylic box set on a plastic grid floor with the pulley and tail harness system attached to the open top of the cage. Food is available from a square food cup recessed into a corner of the floor. In this system, urine, feces, and spilled food fall through the grid floor onto absorbent paper beneath the cage and cannot be separated and recovered quantitatively for analysis in metabolic balance studies. Commercially available metabolic cages are generally cylindrical and have been used with a centrally located suspension apparatus in other space flight models. The large living area, three times as large as most metabolic cages, and the free range of motion unique to Holton's model, essential for musculoskeletal investigations, were sacrificed. Holton's cages can accommodate animals ranging in weight from 70 to 600 g. Although an alternative construction of Holton's cage has been reported, it does not permit collection of separate urine and fecal samples. We describe the modifications to Holton's food delivery system, cage base, and the addition of a separator system for the collection of urine and fecal samples for metabolic and nutrition studies in the tail suspension model.

Derived from text

Metabolism; Physiology; Rats; Weightlessness; Test Facilities; Research Facilities; Bioastronautics

20000070351 Illinois Univ., Dept. of Molecular and Integrative Physiology, Urbana, IL USA

Structure-Function Studies of Native and Recombinant Fish Antifreeze Proteins *Final Report, 1 Mar. 1995 - 31 Feb. 1998*

Cheng–DeVries, Chi–Hing C.; DeVries, Arthur L.; Mar. 16, 2000; 12p; In English

Contract(s)/Grant(s): F49620-95-1-0205

Report No.(s): AD-A376060; AFRL-SR-BL-TR-00-0113; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This project investigates the structures of several fish antifreeze proteins, and how they interact with ice crystals and inhibit ice growth. Formation of hexagonal pit formation on ice crystal basal plane in the presence of fish antifreeze proteins was examined with two-photon fluorescence imaging which showed binding of antifreeze glycoproteins molecules on pit faces; the origin of pit development presumably stems from antifreeze adsorption on dislocations on the basal plane. A novel ice-active protein was isolated from AFGP-bearing notothenioid fish and its partial structure was determined. This protein and AFGP together lead to synergistic augmentation of antifreeze activity and thus has potential bearing on the design of more potent anti-freezing systems. A putative new type of antifreeze peptide was isolated from an Arctic liparid fish and its partial sequence was determined. and lastly, the X-ray crystallographic structure of a type III antifreeze peptide from an Antarctic eel pout and the protein's ice-binding surface were determined.

DTIC

Antifreezes; Proteins; Crystal Structure

20000070363 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Physical Control of Biological Productivity Off the Coast of Peru During the 1997-1998 El Nino

Carr, Mary–Elena, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 9; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Satellite observations and an ecosystem model are used to understand the variability in the planktonic ecosystem off Peru for the period January 1996 to May 1998. The objective of this study is to quantify the changes in the ecosystem components, carbon pathways, and available food for small pelagic fish that occur associated with the change in physical forcing due to El Nino. Two periods are distinguished based on the observed sea level anomaly: a La Nina (LaN) period (1996) in which sea level was below normal and El Nino (EN), the average conditions for December 1997, in which the sea level was anomalously high. There are three phytoplankton size classes (pico-, nano-, and net-phytoplankton) which compete for nutrients and are eaten by three zooplankton size classes. The ecosystem model is forced by alongshore wind speed measured by the NASA Scatterometer (NSCAT) and the European Remote-sensing Satellites (ERS-1 and ERS-2). Larger, slower growing organisms are more sensitive to physical disturbance than smaller organisms (Carr, 1998]. In the present simulation as well, the primary effect of the El Nino (reduced nutrient supply, and increased temperature) is to reduce the biomass of large cells (netphytoplankton) and consequently of the zooplankton that rely on large cells as food source. EN conditions are accompanied by a rearrangement of carbon pathways: comparable uptake goes into reduced biomass accumulation, increased losses to respiration, reduced carbon export, and much reduced carbon available to fish. The star indicates the remotely sensed biomass (assuming a constant carbon to chlorophyll ratio of 60) as measured by the Ocean Color and Temperature Sensor (Nov.-Dec. 1996) and the Sea-viewing Wide Field-of-view Sensor (Dec. 1997). The model, which assumes no light limitation, overestimates total phytoplankton biomass. Additional Information is contained in the original.

Author

Ecosystems; El Nino; Peru; Phytoplankton; Sea Level; Climate Change

20000070749 Arrowhead Space and Telecommunications, Inc., Falls Church, VA USA

Bus Driver Fatigue and Stress Issues Study *Final Report*

Dec. 08, 1999; 120p; In English

Contract(s)/Grant(s): DTGH61-99-Z-00027

Report No.(s): PB2000-106445; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

Arrowhead Space and Telecommunications, Inc. conducted a research project to identify unique aspects of operations within the motorcoach industry which may produce bus driver fatigue and stress. Funding for and oversight of the study was provided by the Federal Highway Administration (FHWA), Office of Motor Carriers (OMC). The purpose of this study is to (1) identify from direct interaction with motorcoach owners, safety directors, operations managers, and drivers those fatigue-inducing stresses which they believe are unique to the motorcoach industry; (2) evaluate the relative influence of these stresses on bus driver fatigue; (3) provide relevant feedback to the FHWA/OMC for its use in future decisions which will affect the motorcoach industry; and

(4) develop an outreach video to help motorcoach drivers understand the effects of fatigue, the stresses that induce it, and means to reduce it.

NTIS

Safety; Stress (Physiology); Fatigue (Biology); Human Performance

20000073285 Massachusetts Inst. of Tech., Dept. of Nuclear Engineering, Cambridge, MA USA

The Behavior of Uranium in the Environment: Bacterial Reduction of an Aqueous Uranium Species

Lewis, Matthew R.; Jun. 2000; 382p; In English

Report No.(s): AD-A377425; No Copyright; Avail: CASI; A17, Hardcopy; A03, Microfiche

Experimental and analytical studies were performed to investigate the behavior of uranium with bacteria in an anaerobic environment. Laboratory studies used Shewanella putrefaciens because of its ability to grow rapidly in aerobic conditions and reduce metals in anaerobic conditions. Under anaerobic conditions, Shewanella putrefaciens use aqueous uranium as the electron acceptor in lieu of oxygen. The reduction of U(VI) to U(IV) removes uranium from solution and forms an insoluble compound known as uraninite. Ultraviolet/Visible Spectroscopy was used to analyze uranium ion complexion with several oxazine dyes that included Brilliant Cresyl Blue, Celestine Blue, and Gallomine Triethoiodide. Complexion and resultant color changes with U(VI) and U(IV) with the dye solutions were tested at a variety of pH levels. The dye behavior was evaluated for future use as a visible reduction indicator for microbial reduction when performing direct plating experiments. These studies showed the best visual indicator to be Celestine Blue. Significant absorbance changes in the 400 to 800 nm wavelength range for Brilliant Cresyl Blue and Gallomine Triethoiodide solutions were not detected. X Ray Diffraction and Electron Microprobe Spectroscopy characterized the solid precipitates by the bacteria. The dark black precipitate exhibited visible characteristics of both $UO_2(s)$ and $U_3O_8(s)$. Electron microprobe showed a very small crystal formed by the bacteria, but was inconclusive with respect to the elemental composition of the mineral. The XRD spectra determined that precipitate was uranium dioxide $UO_2(s)$. The investigation included a time phased uranium isotope analysis in the precipitate and supernatant samples. Thermal Ionization Mass Spectrometry (TIMS) measured the uranium isotopic ratio of U-238/U-235 to determine if microbial reduction of U(VI) to U(IV) affected these ratios.

DTIC

Uranium; Bacteria; Ultraviolet Spectroscopy; Microorganisms; Aerobes; Uranium Isotopes

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.

20000068437 Aeromedical Inst., Soesterberg, Netherlands

Sleep and Alertness Management During Military Operations: Review and Plan of Action *Final Report*

Simons, M., Aeromedical Inst., Netherlands; November 1999; 47p; In English

Contract(s)/Grant(s): A99/M/101

Report No.(s): Rept-1999-K5; Rept-2000-0002; Copyright; Avail: Issuing Activity

Sleep and alertness management is a major point of attention for commanders and the medical support of military round the clock operations. Awareness on the effects of fatigue and sleepiness should be enhanced both on command level and crew level. Flight surgeons and safety officers should be trained to develop and implement mission specific crew endurance plans. Practical guidelines on methods to prevent serious fatigue and to enhance performance and alertness of the crew play a key role in these crew endurance plans. Useful methods include the use of strategic naps, hypnotics, stimulants, and chronobiotic treatment. In the context of the development of guidelines to optimize performance and alertness during sustained and stressful missions, this literature review describes the available knowledge and identifies areas where knowledge is lacking. In this context military relevant research issues related to the use of strategic naps, hypnotics, stimulants, and chronobiotic treatment are put forward. Based on the results of this study, a work program is drawn up, aimed at developing guidelines to optimize performance and alertness during sustained intensive operations.

Author

Sleep; Alertness; Military Operations; Clocks; Fatigue (Biology)

Prevalence of Drugs and Alcohol in Fatal Civil Aviation Accidents Between 1994 and 1998 *Final Report*

Canfield, Dennis V., Civil Aeromedical Inst., USA; Hordinsky, Jerry, Civil Aeromedical Inst., USA; Millett, David P., Federal Aviation Administration, USA; Endecott, Boyd, Civil Aeromedical Inst., USA; Smith, Dudley, Civil Aeromedical Inst., USA; June 2000; 12p; In English

The use of drugs and alcohol in aviation is closely monitored by the FAA Office of Aviation Medicine's (OAM's) Civil Aeromedical Institute (CAMI) through the toxicological analysis of specimens from pilots who have died in aviation accidents. This information on the use of drugs in aviation is helpful to the FAA in developing programs to reduce the usage of dangerous drugs and identify potentially incapacitating medical conditions that may cause an accident. Data collected from this research can be used to evaluate the effectiveness of the FAA drug testing program. The toxicology reports prepared by the CAMI Forensic Toxicology Research Section are used by the FAA and the National Transportation Safety Board to determine the cause of aviation accidents. Specimens (blood, urine, liver, kidney, vitreous fluid, and other bodily specimens) were collected by pathologists near the accident and placed in evidence containers provided by CAMI. These samples were refrigerated and shipped by overnight air. Upon receipt, the specimens were inventoried and accessioned for the analysis of drugs, alcohol, carbon monoxide, and cyanide. All data collected by the laboratory were entered into a computer database for future analysis. The database was searched using a Microsoft Access TM program developed by a local contractor. The database was sorted based on the class of drug, controlled dangerous substance schedules I and II, controlled dangerous substance schedules III-V, prescription drugs, over-the-counter drugs, and alcohol. The Toxicology and Accident Research Laboratory received specimens from 1683 pilots for post-mortem toxicology analysis between 1994 to 1998. Controlled dangerous substances, CDS, (schedules I and II) were found in 89 of the pilots analyzed. Controlled dangerous substances (schedules III - V) were found in 49 of the pilots tested. Prescription drugs were found in 240 of the pilots analyzed. Over-the-counter drugs were found in 301 of the pilots analyzed. Alcohol at or above the legal limit of 0.04% was found in 124 pilots. The number of positive drug cases has doubled over the past 5 years. Over-the-counter medications are the most frequently found drugs in fatal aviation accidents and many of these drugs, or the medical conditions for which they are being used, could impair a pilot's ability to safely fly an aircraft. The increased number of positive cases found in this research is most likely the result of improved methods of analysis, rather than an increase in the use of drugs. The low incidence of CDS III-V drugs found in fatal aviation accidents may be a result of the difficulty in finding and identifying the new benzodiazepines commonly prescribed in this class.
Author
Aircraft Accidents; Alcohols; Civil Aviation; Drugs; Death; Aerospace Medicine; Aircraft Pilots

Beta-Adrenergic Blockade Does not Prevent Polycythemia or Decrease in Plasma Volume in Men at 4300 m Altitude

Grover, R. F., Colorado Univ., USA; Selland, M. A., Colorado Univ., USA; McCullough, R. G., Colorado Univ., USA; Dahms, T. E., Saint Louis Univ. School of Medicine, USA; Wolfel, E. E., Colorado Univ., USA; Butterfield, G. E., Palo Alto Veterans Administration Health Care System, USA; Reeves, J. T., Colorado Univ., USA; Greenleaf, J. E., NASA Ames Research Center, USA; European Journal of Applied Physiology; 1998; Volume 77, pp. 264-270; In English

When humans ascend to high altitude (ALT) their plasma volume (PV) and total blood volume (BV) decrease during the first few days. With continued residence over several weeks, the hypoxia-induced stimulation of erythropoietin increases red cell production which tends to restore BV. Because hypoxia also activates the beta-adrenergic system, which stimulates red blood cell production, we investigated the effect of adrenergic beta-receptor inhibition with propranolol on fluid volumes and the polycythemic response in 11 healthy unacclimatized men (21-33 years old exposed to an ALT of 4300 m (barometric pressure 460 Torr) for 3 weeks on Pikes Peak, Colorado. PV was determined by the Evans blue dye method (PV(sub EB)), BV by the carbon monoxide method (BV(sub CO)), red cell volume (RCV)was calculated from hematocrit (Hct) and BV(sub CO), and serum erythropoietin concentration ([EPO]) and reticulocyte count, were also determined. All determinations were made at sea level and after 9-11 (ALT-10) and 9-20 (ALT-20) days at ALT. At sea level and ALT, six men received propranolol (pro, 240 mg/day), and five received a placebo (pla). Effective beta-blockade did not modify the mean (SE) maximal values of [EPO] [pla: 24.9 (3.5) vs pro: 24.5 (1.5) mU/ml] or reticulocyte count [pla: 2.7 (0.7) vs pro: 2.2 (0.5)%]; nor changes in PV(sub EB)[pla: -15.8 (3.8) vs pro: -19.9 (2.8)%], RCV(sub CO) [pla: +7.0 (6.7) vs pro: +10.1 (6.1)%], or BV(sub CO) [pla: -7.3 (2.3) vs pro: -7.1 (3.9)%]. In the

absence of weight loss, a redistribution of body water with no net loss is implied. Hence, activation of the beta-adrenergic system did not appear to affect the hypovolemic or polycythemic responses that occurred during 3 weeks at 4300 m ALT in these subjects. Author

Adrenergics; Antiadrenergics; Blood Volume; Hematopoietic System; Hematocrit; Erythrocytes; Hypovolemia; Polycythemia; Reticulocytes

20000069799 NASA Ames Research Center, Moffett Field, CA USA

Exercise Thermoregulation After 6 hours of Chair Rest, 6 deg Head-Down Bed-Rest, and Water Immersion Deconditioning in Men

Greenleaf, J. E., NASA Ames Research Center, USA; Hutchinson, T., NASA Ames Research Center, USA; Shaffer–Bailey, M., NASA Ames Research Center, USA; Looft–Wilson, R., NASA Ames Research Center, USA; Eur Journal of Applied Physiology; 1996; Volume 72, pp. 303-309; In English

Contract(s)/Grant(s): RTOP 199-18-12-07; Copyright; Avail: Issuing Activity

The purpose was to investigate the mechanism for the excessive exercise hyperthermia following deconditioning (reduction of physical fitness). Rectal (T(sub re)) and mean skin (T(bar)(sub sk)) temperatures and thermoregulatory responses were measured in six men [mean (SD) age, 32 (6) years; mass, 78.26 (5.80) kg; surface area, 1.95 (0.11) sq m; maximum oxygen uptake (VO2max), 48 (6) ml/min/kg; whilst supine in air at dry bulb temperature 23.2 (0.6)C, relative humidity 31.1 (11.1)% and air speed 5.6 (0.1) m/min] during 70 min of leg cycle exercise [51 (4)% VO2max] in ambulatory control (AC), or following 6 h of chair rest (CR), 6deg head-down bed rest (BR), and 20deg (W120) and 80deg (W180) foot-down water immersion [water temperature, 35.0 (0.1) C]. Compared with the AC exercise (Delta)T(sub re) [mean (SD) 0.77 (0.13)C], (Delta)T(sub re), after CR was 0.83 (0.08)C (NS), after BR 0.92 (0.13)C (*P is less than 0.05), after W180 0.96 (0.13)C*, and after W120 1.03 (0.09)C*. All T(sub sk) responded similarly to exercise: they decreased (NS) by 0.5-0.7 C in minutes 4-8 and equilibrated at +0.1 to +0.5 C at 60-70. Skin heat conductance was not different among the five conditions (range = 147-159 kJ/sq/C. Results from an intercorrelation matrix suggested that total body sweat rate was more closely related to T(sub re) at 70 min (T(sub re70)) than limb sweat rate or blood flow. Only 36% of the variability in T(sub re70) could be accounted for by total sweating, and less than 10% from total body dehydration. It would appear that multiple factors are involved which may include change in sensitivity of thermo- and osmoreceptors. Author

Physical Exercise; Thermoregulation; Deconditioning; Water Immersion; Bed Rest; Hyperthermia; Males

20000070333 Army Research Inst. of Environmental Medicine, Military Performance Div., Natick, MA USA

The Effects of backpack weight on the biomechanics of load carriage

Harman, Everett; Hoon, Ki; Frykman, Peter; Pandorf, Clay; May 03, 2000; 72p; In English

Report No.(s): AD-A377886; USARIEM-T00-17; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An analysis of the effects of 4 backpack loads (6, 20, 33, and 44 kg) on walking gait was performed on 16 male volunteers using a cinematographic system, force platform, tri-axial accelerometer, and 6 surface electrodes located over the trapezius, spinal erector, quadricep, hamstring, gastrocnemius and tibialis anterior muscles. When the load became very heavy, stride frequency increased. Double-support as percent of stride increased along with the load, effected by a delayed floor push-off. Knee range of motion increased with load during the eccentric knee flexion period from heel-strike until mid-stance. A lower total body center of mass position as the load increased was effected both by greater knee flexion and a more forward leaning trunk. An initial propulsive impulse at heel-strike resulted from flexion at the knee rather than from extension at the hip. A protective gait adjustment when increasing to the heaviest load limited the medial travel of the center of mass. As the load increased, hip extensor torque increased proportionately. Yet knee extensor torque increased more than expected, while ankle plantarflexor torque increased less than expected. Trapezius muscle activity showed that the frame-and-belt system did not prevent the shoulders from supporting considerable load. The spinal erectors produced the largest burst of activity at contralateral heel-strike. The gastrocnemius was largely inactive except for high activity during push-off, which did not increase with very heavy loads. The burden of carrying a very heavy load fell less on the calf muscles than on the muscles around the knee and hip. Trunk forward/downward excursion and acceleration increased with load. The erector spinae acted eccentrically to decelerate trunk motion as the trunk approached its maximum forward lean. Slack in the straps enabled peak forward acceleration of the pack to occur later and be of lower magnitude than the peak forward acceleration of the trunk. DTIC

Physiological Effects; Activity (Biology); Biodynamics; Muscular Function

National Defence Research Establishment, Div. of Human Sciences, Linkoeping, Sweden
Testing Models for Estimating Physical Working Capacity *Proevning av Skattningsmodeller foer Arbetsprovet*
Wenemark, R.; Aven, A.; Sep. 1998; 24p; In Swedish
Report No.(s): PB2000-103097; FOA-R-98-00855-720-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This document describes two models (Model 1 and 2) for estimating physical working capacity. The purpose of using a model is that draftees can be estimated even though they can not accomplish the physical working capacity test. by using a model the estimation of a draftee will also be equal all over the country. The two models are based on the draftees weight and estimation of their condition compared to their classmates. Those two variables create the two suggested models. The models use different criteria of the variables when estimating the draftees.
NTIS
Performance Tests; Work Capacity; Muscular Strength

NASA Ames Research Center, Moffett Field, CA USA
Leucocytosis, Thrombocytosis, and Plasma Osmolality During Rest and Exercise: A Hypothesis
McKenzie, M. A., San Francisco State Univ., USA; Greenleaf, John E., NASA Ames Research Center, USA; Looft–Wilson, R., NASA Ames Research Center, USA; Barnes, P. R., San Francisco State Univ., USA; Journal of Physiology and Pharmacology; 1999; Volume 50, No. 2, pp. 259-273; In English; Sponsored in part by Shaklee Technica
Contract(s)/Grant(s): NGT-50686; NAG8-227; JSRA-7; RTOP 199-18-07; Copyright; Avail: Issuing Activity

The mechanism for inducing leucocytosis (increase in white blood cells) and thrombocytosis (increase in platelets) during exercise is unclear. Because plasma osmolality (Osm) may influence T-cell proliferation, Osm and the number of leucocytes (WBC) and platelets in blood were measured periodically during a 90 min rest period, and were compared with those during upright sitting ergometer exercise in six unt.rained, healthy men who cycled for 70 min at 71% of their maximal oxygen uptake (V prime O(sub 2(sub max)). There were 6 experiments in which the subjects drank different fluid formula-t4ilons (10 ml/kg) of various ionic and osmotic concentrations intermittently during 60 min of the rest period and during the exercise period. Osmolality, and WBC and platelet counts increased significantly (pis less than 0.05) within the first 10 min of exercise, but the additional 60 min of exercise did not significantly change the leucocytosis or thrombocytosis. There were low but significant correlations between individual values of total WBC and total Osm during exercise (r(sub 0.001(2),284) = 0.39) and during rest plus exercise (r(sub 0.001(2),499) = 0.43). With combined data from the six experiments, mean Osm correlated highly and significantly with both mean WBC (r(sub 0.001(2),6) = 0.95, p is less than 0.001) and mean platelets (r(sub 0.001(2),6) = 0.94, p is less than 0.01) during the exercise phase. These data indicate that increases in leucocytes, thrombocytes, and osmolality occur primarily within the first 10 min of high-intensity exercise, but neither hypovolemia nor hyperthermia during exercise contributed to the leucocytosis, thrombocytosis, or hyperosmolality. The high correlations between plasma Osm and WBC or platelet counts suggest changes in osmolality may contribute to the mechanism of leucocytosis and thrombocytosis induced by exercise.
Author
Leukocytes; Thrombocytes; Platelets; Plasmas (Physics); Osmosis; Cell Membranes (Biology); Regeneration (Physiology)

Kyoto Prefectural Univ., Dept. of Physiology, Kyoto, Japan
Effect of an Exercise-Heat Acclimation Program on Body Fluid Regulatory Responses to Dehydration in Older Men
Takamata, Akira, Kyoto Prefectural Univ., Japan; Ito, Tomoyuki, Kyoto Prefectural Univ., Japan; Yaegashi, Kazuhiro, Kyoto Prefectural Univ., Japan; Takamiya, Hisatake, Kyoto Prefectural Univ., Japan; Maegawa, Yasuyo, Kyoto Prefectural Univ., Japan; Itoh, Toshiyuki, Kyoto Prefectural Univ., Japan; Greenleaf, John E., Kyoto Prefectural Univ., Japan; Morimoto, Taketoshi, Kyoto Prefectural Univ., Japan; American Journal of Physiology; 1999; ISSN 0363-6119; Volume 277, No. 4, pp. R1041-R1050; In English; Sponsored in part from the Foundation of Total Health Promotion; Copyright; Avail: Issuing Activity

Effect of an exercise-heat acclimation program on body fluid regulatory response to dehydration in older men. We examined if an exercise-heat acclimation program improves body fluid regulatory function in older subjects, as has, been reported in younger subjects. Nine older (Old; 70 plus or minus 3 yr) and six younger (Young; 25 plus or minus 3 yr) male subjects participated in the study. Body fluid regulatory responses to n acute thermal dehydration challenge were examined before and after the 6-day acclimation session. Acute dehydration was produced by intermittent light exercise [4 bouts of 20-min exercise at 40% peak rate of oxygen consumption VO2 peak) separated by 10 min rest] in the heat (36 C; 40% relative humidity) followed by 30 min of recovery without fluid intake at 25 C. During the 2-h rehydration period the subjects drank a carbohydrate-electrolyte solution ad libitum. In the preacclimation test, the Old lost approximately 0.8 kg during dehydration and recovered 31 plus or minus 4% of that loss during rehydration, whereas the Young lost approximately 1.2 kg and recovered 56 plus or minus 8% (P less than 0.05, Young vs. Old). During the 6-day heat acclimation period all subjects performed the same exercise-heat exposure as in the

dehydration period. Exercise-heat exposure as in the dehydration period. Exercise-heat acclimation increased plasma volume by approximately 5% (P less than 0.05) in Young subjects but not in Old. The body fluid loss during dehydration in the postacclimation test was similar to that in the preacclimation in Young and Old. The fractional recovery of lost fluid volume during rehydration increased in Young (by 80 plus or minus 9%; P less than 0.05) but not in Old (by only 34 plus or minus 5%; NS). The improved recovery from dehydration in Young was mainly due to increased fluid intake with a small increase in the fluid retention fraction. The greater involuntary dehydration (greater fluid deficit) in Old was accompanied by reduced plasma vasopressin and aldosterone concentrations, renin activity, and subjective thirst rating (P less than 0.05, Young vs. Old). Thus older people have reduced ability to facilitate body fluid regulatory function by exercise-heat acclimation, which might be involved in attenuation of the acclimation-induced increase in body fluid volume.
Author
Body Fluids; Dehydration; Males; Physical Exercise; Heat Acclimatization

20000070843 Northeastern Forest Experiment Station, Forestry Sciences Lab., Delaware, OH USA
Ultraviolet Radiation, Human Health and the Urban Forest *Final Report*
Heisler, G. M.; Grant, R. H.; 2000; 44p; In English
Report No.(s): PB2000-104066; FSGTR-NE-268; NEFES/00-3; No Copyright; Avail: National Technical Information Service (NTIS)

Excess exposure to ultraviolet (UV) radiation from the sun, particularly the ultraviolet B (UVB) portion, has been definitely linked with adverse effects on human health, including inducement of skin cancers and eye diseases. Trees may prevent even greater disease rates in humans by reducing UV exposure. Trees greatly reduce UV irradiance in their shade when they obscure both the sun and sky. However, at locations where trees obscure the sun but leave much of the sky in view, UV radiation is much more prevalent than is suggested by the appearance of the visible shadow. Recent measurements of leaf optical properties and algorithms describing sky-radiance distributions will provide information for generating computer models of the effect of trees on UV radiation. These models will be useful in estimating the climatology of UV irradiance in urban areas with trees and buildings, and will aid epidemiological studies and in preparing illustrations of shade patterns for use in public education programs. NTIS
Forests; Ultraviolet Radiation; Health Physics; Cities; Exposure

20000070857 NASA Ames Research Center, Moffett Field, CA USA
Intensive Exercise Training During Bed Rest Attenuates Deconditioning
Greenleaf, John E., NASA Ames Research Center, USA; Medicine and Science in Sports and Exercise; 1997; ISSN 0195-9131, pp. 207-215; In English
Contract(s)/Grant(s): NAG2-410; MRDC-3A161101A-91C; RTOP 199-21-12; RTOP 199-22-12; RTOP 199-22-22; RTOP 199-22-32; Copyright; Avail: Issuing Activity

Intensive exercise training during bed rest attenuates deconditioning. Med. Sci. Sports Exerc., Vol. 29, No. 2, pp. 207-215, 1997. A 30-d 6 deg head-down bed rest project was conducted to evaluate variable high-intensity, short-duration, isotonic cycle ergometer exercise (ITE) training and high-intensity intermittent resistive isokinetic exercise (IKE) training regimens designed to maintain peak VO2 and muscle mass, strength, and endurance at ambulatory control levels throughout prolonged bed rest. Other elements of the deconditioning (adaptive) syndrome, such as proprioception, psychological performance, hypovolemia, water balance, body composition, and orthostatic tolerance, were also measured. Major findings are summarized in this paper. Compared with response during bed rest of the no exercise (NOE) control group: the ITE training regimen (a) maintained work capacity (peak VO2), (b) maintained plasma and red cell volumes, (c) induced positive body water balance, (d) decreased quality of sleep and mental concentration, and (e) had no effect on the decrease in orthostatic tolerance; the IKE training regimen (f) attenuated the decrease in peak VO2 by 50%, (g) attenuated loss of red cell volume by 40% but had no effect on loss of plasma volume, (b) induced positive body water balance, (i) had no adverse effect on quality of sleep or concentration, and 0) had no effect on the decrease in orthostatic tolerance. These findings suggest that various elements of the deconditioning syndrome can be manipulated by duration and intensity of ITE or IKE training regimens and that several different training protocols will be required to maintain or restore physiological and psychological performance of individuals confined to prolonged bed rest.
Author
Physical Exercise; Deconditioning; Education; Orthostatic Tolerance; Physiology; Sleep; Bed Rest

20000072498 Defence Science and Technology Organisation, Melbourne Australia

Support For International Conference on Physiological and Cognitive Performance In Extreme Environments *Final Report*

Lau, Tony; Jul. 2000; 230p; In English

Contract(s)/Grant(s): DAMD17-00-1-0059

Report No.(s): AD-A377296; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The proceedings for the International Conference on Physiological and Cognitive Performance in Extreme Environments is presented.

DTIC

Conferences; Mental Performance; Physiology; Cognition; Fatigue (Biology)

20000073250 Army Research Inst. of Environmental Medicine, Natick, MA USA

Effect of Smoking on Cutaneous Vascular Responses to Exercise in Healthy, Exercise-Trained, Heat-Acclimated Humans

Stephenson, Lou A.; Mair, Brent S.; Boulant, Catherine G.; Staab, Janet; Kesick, Christina M.; May 2000; 24p; In English

Report No.(s): AD-A377808; USARIEM-T00-19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this study was to examine vascular responses to exercise in individuals with a risk factor for atherogenesis compared to individuals who did not share that particular risk. It was hypothesized that smokers (S; n=4) had less compliant cutaneous vessels than nonsmokers (NS; n=4). Esophageal (Tes) and skin temperatures (Tsk), heart rate (HR), blood pressure, forearm skin blood flow (SkBF) and forearm blood flow (FBF) were measured at rest, during 30 min cycle exercise (60% peak aerobic power), following arterial occlusion (reactive hyperemia) and during recovery at 30 degrees Centigrade. Tes, Tsk and FBF were not different between S and NS at rest, during exercise or recovery. HR was higher in smokers at rest (S =69+9; NS=58+5 bpm; p=0.05) and during recovery (S=90+10; NS=75+10 bpm; p=0.07), but not different during exercise. During hyperemia, cutaneous vascular conductance (SkBF/MAP) averaged 3.5 ml/100 ml/min/Torr lower in S than NS (p=0.03). Thermoregulatory responses were not compromised during the 30-min exercise in a warm environment. However, during recovery, HR was increased and reactive hyperemia was decreased in smokers.

DTIC

Physical Exercise; Cardiovascular System; Physiological Responses; Human Beings; Heat Acclimatization; Nicotine

20000073312 Army Research Inst. of Environmental Medicine, Military Performance Div., Natick, MA USA

Physiologic and Pathologic Responses to Heat Stress

Wenger, C. B.; Oct. 1998; 16p; In English

Report No.(s): AD-A377503; MISC-99-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The most important responses in humans for removing heat from the body are sweating, which increases heat loss by evaporation, and cutaneous vasodilation, which increases skin blood flow and heat transfer from core to skin. Intense exercise can increase heat production within the body ten-fold or more. For the first few minutes of exercise, most of the heat produced is retained within the body, raising core temperature until it elicits heat-dissipating responses sufficient to eliminate heat as fast as it is produced. Because of the levels of skin blood flow needed for high rates of heat dissipation in a hot environment exercise and heat dissipation make competing demands on the cardiovascular system. In addition, if water and electrolytes lost as sweat are not replaced, plasma volume eventually is depleted, thus reducing central blood volume and impairing cardiac filling. Through these mechanisms, secondary effects of the thermoregulatory responses contribute to many of the adverse effects of heat stress, though other mechanisms related to high core temperature also have a role, especially in heat stroke. Heat tolerance is increased by aerobic exercise conditioning and by acclimatization to heat. Conversely, poor physical fitness and certain disease states and drugs are associated with impairment of the thermoregulatory responses. The foregoing factors account for most of the inter-individual differences in heat tolerance associated with gender and age.

DTIC

Body Temperature; Heat Tolerance; Physical Fitness; Pathology; Physiological Effects; Skin (Anatomy); High Temperature Environments; Physical Exercise; Physiological Responses; Heat Acclimatization; Thermoregulation

20000073315 Army Research Inst. of Environmental Medicine, Natick, MA USA

Exercise and Core Temperature

Wenger, C. B.; Mar. 1999; 25p; In English

Report No.(s): AD-A377492; MISC-99-6; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In humans the most important responses for removing heat from the body are sweating, which increases heat loss by evaporation, and cutaneous vasodilation, which increases skin blood flow and heat transfer from core to skin. Vigorous exercise can

increase heat production within the body ten-fold or more. During the first few minutes of exercise, most of the heat produced is retained within the body, raising core temperature until it elicits heat-dissipating responses sufficient to eliminate heat as fast as it is produced. The steady-state increase in core temperature is proportional to the rate of heat production and, within certain limits, independent of environmental conditions. Because of the levels of skin blood flow needed for high rates of heat dissipation in a hot environment, exercise and heat dissipation make competing demands on the cardiovascular system. Moreover, if water and electrolytes lost as sweat are not replaced, plasma volume eventually is depleted, thus reducing central blood volume and impairing cardiac filling. Through these mechanisms, secondary effects of the thermoregulatory responses contribute to many of the adverse effects of heat stress, though other mechanisms related to high core temperature also have a role, especially in heat stroke. Heat tolerance is increased by aerobic exercise conditioning and by acclimatization to heat. Conversely, poor physical fitness and certain disease states and drugs are associated with impairment of the thermoregulatory responses. The foregoing factors account for most of the inter-individual differences in heat tolerance associated with gender and age. Because of the high rates of heat production, heat-related illnesses are much more likely during exercise than is hypothermia. However, hypothermia may occur during prolonged exercise due to inadequate clothing, changes in the weather, or fatigue or musculoskeletal injury which reduces the level of exercise that can be sustained.
DTIC

Physical Exercise; Body Temperature; Heat Tolerance; Blood Circulation; Physical Fitness; Sweat; Heat Acclimatization; Physiological Effects; High Temperature Environments; Physiological Responses; Thermoregulation

20000073392 NASA Ames Research Center, Moffett Field, CA USA
Neuroendocrine and Immune System Responses with Spaceflights
Tipton, Charles M., NASA Ames Research Center, USA; Greenleaf, John E., NASA Ames Research Center, USA; Jackson, Catherine G. R., NASA Ames Research Center, USA; Medicine and Science in Sports and Exercise; 1996; ISSN 0195-9131, pp. 988-998; In English; Copyright; Avail: Issuing Activity

Despite the fact that the first human was in space during 1961 and individuals have existed in a microgravity environment for more than a year, there are limited spaceflight data available on the responses of the neuroendocrine and immune systems. Because of mutual interactions between these respective integrative systems, it is inappropriate to assume that the responses of one have no impact on functions of the other. Blood and plasma volume consistently decrease with spaceflight; hence, blood endocrine and immune constituents will be modified by both gravitational and measurement influences. The majority of the in-flight data relates to endocrine responses that influence fluids and electrolytes during the first month in space. Adrenocorticotropin (ACTH), aldo-sterone. and anti-diuretic hormone (ADH) appear to be elevated with little change in the atrial natriuretic peptides (ANP). Flight results longer than 60 d show increased ADH variability with elevations in angiotensin and cortisol. Although post-flight results are influenced by reentry and recovery events, ACTH and ADH appear to be consistently elevated with variable results being reported for the other hormones. Limited in-flight data on insulin and growth hormone levels suggest they are not elevated to counteract the loss in muscle mass. Post-flight results from short- and long-term flights indicate that thyroxine and insulin are increased while growth hormone exhibits minimal change. In-flight parathyroid hormone (PTH) levels are variable for several weeks after which they remain elevated. Post-flight PTH was increased on missions that lasted either 7 or 237 d, whereas calcitonin concentrations were increased after 1 wk but decreased after longer flights. Leukocytes are elevated in flights of various durations because of an increase in neutrophils. The majority of post-flight data indicates immunoglobulin concentrations are not significantly changed from pre-flight measurements. However, the numbers of T-lymphocytes and natural killer cells are decreased with post-flight conditions. of the lymphokines, interleukin-2 production, lymphocyte responsiveness, and the activity of natural killer cells are consistently reduced post-flight. Limited head-down tilt (HDT) data suggest it is an effective simulation model for microgravity investigations. Neuroendocrine and pharmacological countermeasures are virtually nonexistent arid should become high priority items for future research. Although exercise has the potential to be an effective countermeasure for various neuroen-docrine-immune responses in microgravity, this concept must be tested before flights to Mars are scheduled.
Author

Blood Plasma; Countermeasures; Endocrine Systems; Hypokinesia; Immune Systems; In-Flight Monitoring; Measuring Instruments; Microgravity; Physiological Responses

20000073801 Energia Nucleare e Delle Energie Alternative, Centro Ricerche 'Ezio Clementel, Bologna, Italy
Bico 2: second national intercomparison campaign of WBC centres working in Italy
Castellani, C. M.; Battisti, P.; Tarroni, G.; Dec. 31, 1998; 66p; In Italian; In English
Report No.(s): DE99-722875; ENEA-RT-AMB-98-11; No Copyright; Avail: Department of Energy Information Bridge

During the period November 1994 - May 1995 the coordinating group of WBC centres working in Italy organized the 2. national intercalibration and intercomparison campaign. A BOMAB phantom was used filled with four radionuclides gel solution with gamma energy emissions ranging between 100 keV and 2 MeV. 17 out of 21 Italian WBC centres took part in the campaign. Through the intercalibration, organized according to internationally accepted methodologies, each WBC centre could check its own calibration procedures. many intermediate data, collected for the methodologies and measurement procedures intercomparison, permitted analyses and comparison of uncertainly causes in a WBC measurement of the internal contamination. A proposal of MDA definition and assessment procedure resulted from the intercomparison campaign.
NTIS

Contamination; Radiation Detectors; Aerospace Medicine

20000073802 Energia Nucleare e Delle Energie Alternative, Centro Ricerche 'Ezio Clementel, Bologna, Italy
Valdose program: methodologies for dose assessment in internal contamination, 1997 census
Castellani, C. M.; Battisti, P.; Tarroni, G.; Dec. 31, 1998; 31p; In Italian; In English
Report No.(s): DE99-722874; ENEA-RT-AMB-98-10; No Copyright; Avail: Department of Energy Information Bridge

Dose assessment in internal dosimetry needs computational and interpretative tools that allow carrying out, as a first step, an evaluation of intake on the base of bioassay measurements or WBC measurements, and as a second step, dose evaluation on the base of estimated intake. In the frame of the MIDIA Co-ordination (WBC operating in Italy), in the first months of 1997 a census on methodologies for dose evaluation in internal contamination has been proposed. A technical form has been sent to all the WBC Centres allowing an accurate description of modalities used in each centre. 9 out of 17 centres sent the answers to the technical form in time. In this paper all the forms filled in are reported. A careful comparative evaluation of the answers has been made both for routine monitoring and for special monitoring. The various radionuclides present in the Italian reality, calculation methodologies both for intake and dose, hypotheses adopted for date, path and modalities of contaminations are also presented. Proposals for conforming to the methodology in Italy after the introduction of the models following ICRP 60 publication that are the base of the Euratom 96/29 Directive are also discussed.
NTIS

Dosage; Contamination; Software Development Tools; Aerospace Medicine

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20000068454 NASA Johnson Space Center, Houston, TX USA
Antarctic Space Analog Program *Final Report, 1 Jul. 1997 - 31 Dec. 1998*
Palinkas, Lawrence A, California Univ., San Diego, USA; Gunderson, E. K. Eric, Naval Health Research Center, USA; Johnson, Jeffrey C., East Carolina Univ., USA; Holland, Albert W., NASA Johnson Space Center, USA; [1998]; 8p; In English
Contract(s)/Grant(s): NAG5-4571; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The primary aim of this project was to examine group dynamics and individual performance in extreme, isolated environments and identify human factors requirements for long-duration space missions using data collected in an analog environment. Specifically, we wished to determine: 1) the characteristics of social relations in small groups of individuals living and working together in extreme, isolated environments, and 2) the environmental, social and psychological determinants of performance effectiveness in such groups. These two issues were examined in six interrelated studies using data collected in small, isolated research stations in Antarctica from 1963 to the present. Results from these six studies indicated that behavior and performance on long-duration space flights is likely to be seasonal or cyclical, situational, social, and salutogenic in nature. The project responded to two NASA program emphases for FY 1997 as described in the NRA: 1) the primary emphasis of the Behavior and Performance Program on determining long-term individual and group performance responses to space, identifying critical factors affecting those responses and understanding underlying mechanisms involved in behavior and performance, and developing and using ground-based models and analogs for studying space-related behavior and performance; and 2) the emphasis of the Data Analysis Program on extended data analysis. Results from the study were used to develop recommendations for the design and development of pre-flight crew training and in-flight psychological countermeasures for long-duration manned space missions.
Author

Group Dynamics; Long Duration Space Flight; Sociology; Human Relations; Space Psychology; Social Factors; Space Flight Stress

20000068515 NASA Johnson Space Center, Houston, TX USA

Behavior and Performance on Long-Duration Spaceflights: Evidence from Analogue Environments

Palinkas, Lawrence A., California Univ., USA; Gunderson, E. K. Eric, Naval Health Research Center, USA; Johnson, Jeffrey C., East Carolina Univ., USA; Holland, Albert W., NASA Johnson Space Center, USA; [1999]; 28p; In English

Contract(s)/Grant(s): NAG5-4571; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Analyses of data collected in Antarctica since 1963 were conducted to identify features of behavior and performance likely to occur during long-duration missions in space.The influence of mission duration and station latitude on POMS mood scores was examined in 450 American men and women who overwintered in Antarctica between 1991 and 1998. The influence of crew-member social characteristics, personality traits, interpersonal needs, and station environments on measures of behavior and performance at the end of the austral winter was examined in 657 American men who overwintered between 1963 and 1974. Both data sets were used to examine the influence of crew social structure on individual performance. Results: Seasonal variations in mood appear to be associated with the altered diurnal cycle and psychological segmentation of the mission. Concurrent measures of personality, interpersonal needs, and coping styles are better predictors of depressed mood and peer-supervisor performance evaluations than baseline measures because of the unique features of the station social and physical environments and the absence of resources typically used to cope with stress elsewhere. Individuals in crews with a clique structure report significantly more depression, anxiety, anger, fatigue and confusion than individuals in crews with a core-periphery structure. Depressed mood is inversely associated with severity of station physical environment, supporting the existence of a positive or "salutogenic" effect for individuals seeking challenging experiences in extreme environments.

Author

Antarctic Regions; Human Beings; Predictions; Personality; Moods

20000068932 California Univ., San Diego, Dept. of Family and Preventive Medicine, La Jolla, CA USA

Sleep and Mood During A Winter in Antarctica

Palinkas, Lawrence A., California Univ., San Diego, USA; Houseal, Matt, Texas Technological Univ., USA; Miller, Christopher, California Univ., San Diego, USA; International Journal of Circumpolar Health; [2000], pp. 63-73; In English

Contract(s)/Grant(s): NAG5-4571; NSF DDP-90-96178; Copyright; Avail: Issuing Activity

Seasonal variations in sleep characteristics and their association with changes in mood were examined in 91 American men and women also who spent the 1991 austral winter at three different research stations in Antarctica. Measures of total hours of sleep over a 24-hr period, duration of longest (i.e.,"nighttime") sleep event, number of sleep events, time of sleep onset, and quality of sleep remained unchanged over the course of the austral winter (March through October). However, exposure to total darkness based on station latitude was significantly associated with total hours of sleep, duration of are longest sleep event, time of sleep onset, and quality of sleep. Reported vigor the previous month was a significant independent predictor of changes in all five sleep measures; previous month's measures of all six POMS subscales were significant independent predictors of sleep quality. Sleep characteristics were significant independent predictors of vigor and confusion the following month; total sleep, longest sleep event, sleep onset and sleep quality were significant independent predictors of tension-anxiety and depression. Changes in mood during the austral winter are preceded by changes in sleep characteristics, but prolonged exposure to the photoperiodicity characteristic of the high latitudes appears to be associated with improved sleep. In turn, mood changes appear to affect certain sleep characteristics, especially sleep quality.

Author

Antarctic Regions; Human Beings; Moods; Sleep; Psychological Effects; Physiological Responses

20000070852 Civil Aeromedical Inst., Oklahoma City, OK USA

Age and Attitudes in the Air Traffic Control Specialist Workforce: An Initial Assessment *Final Report*

Thompson, Richard C., Civil Aeromedical Inst., USA; Bailey, Lawrence L., Civil Aeromedical Inst., USA; May 2000; 14p; In English

Contract(s)/Grant(s): AM-B-99-HRR-516

Report No.(s): DOT/FAA/AM-00/17; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The present study examines the relationships between air traffic control specialist age, after covarying job tenure, with perceptions of job satisfaction, quality of work life, organizational commitment, and supervisory fairness. The presence of a relationship and the shape of the relationship are examined for four categories of controllers based on air traffic option or work setting (i.e., working in an enroute, flight service stations, Level 1 to 3 or level 4 or 5 terminal (towers and tracons)). The results suggest that there is a small linear relationship between age and attitudes. Similar patterns have been found in age research in other work settings. There are some differences in the shape of the age function based on air traffic option; these differences account for minimal variance. It may be fruitful to develop a more focused study where age is measured as a continuous variable instead of

using age categories, which may have masked some differences found in past research. In addition, future research may consider examining the age and attitudes relationships using international controllers to determine if there are cultural differences in the relationships found.

Author

Age Factor; Air Traffic Controllers (Personnel); Organizations; Personnel Management; Human Relations; Employee Relations

20000072432 Institute for Human Factors TNO, Soesterberg, Netherlands

Pilot Studies on the Freezing Illusion *Interim Report Pilot Studies Naar de Zgn. Bevries-Illusie*

Wertheim, A. H., Institute for Human Factors TNO, Netherlands; Feb. 14, 2000; 25p; In English

Contract(s)/Grant(s): TNO Proj. 789.3; B99-043

Report No.(s): TD-00-0112; TM-00-B001; Copyright; Avail: Issuing Activity

In a number of pilot studies the freezing illusion (a grating, moving on a monitor, appears to 'freeze' on the monitor when that monitor itself is moved in the opposite direction; see Mesland en Wertheim, 1997) was investigated. The hypothesis was put forward that it may be a special case of the Pavard and Berthoz effect (during head- or ego-movements constant motion of a large visual pattern relative to the observers head appears to "freeze" in front of the head; see Pavard en Berthoz, 1977), meaning that both have a common denominator: the presence of a reference signal within the visual system (reference signals inform the visual system about self movements to enable a correct interpretation of retinal image motion). The pilot studies suggest that this hypothesis is incorrect and that the two phenomena seem to be of a different nature. They suggest that there is no need for a further test of this particular explanation of the Freezing illusion. A different explanation is, however, still lacking. On the other hand, the data support the opposite claim (Wertheim, 1994) that reference signals have no effect on the perception of relative motion between objects with respect to each other.

Author

Image Motion Compensation; Head Movement; Visual Signals; Retinal Images

20000073287 NASA Johnson Space Center, Houston, TX USA

Predictors of Behavior and Performance in Extreme Environments: The Antarctic Space Analogue Program

Palinkas, Lawrence A., California Univ., San Diego, USA; Gunderson, E K. Eric, Naval Health Research Center, USA; Holland, A. W., NASA Johnson Space Center, USA; Miller, Christopher, California Univ., San Diego, USA; Johnson, Jeffrey C., East Carolina Univ., USA; Aviation, Space, and Environmental Medicine; June 2000; Volume 71, No. 6, pp. 619-625; In English

Contract(s)/Grant(s): NAG5-4571; Copyright; Avail: Issuing Activity

To determine which, if any, characteristics should be incorporated into a select-in approach to screening personnel for long-duration spaceflight, we examined the influence of crewmember social/ demographic characteristics, personality traits, interpersonal needs, and characteristics of station physical environments on performance measures in 657 American men who spent an austral winter in Antarctica between 1963 and 1974. During screening, subjects completed a Personal History Questionnaire which obtained information on social and demographic characteristics, the Deep Freeze Opinion Survey which assessed 5 different personality traits, and the Fundamental Interpersonal Relations Orientation-Behavior (FIRO-B) Scale which measured 6 dimensions of interpersonal needs. Station environment included measures of crew size and severity of physical environment. Performance was assessed on the basis of combined peer-supervisor evaluations of overall performance, peer nominations of fellow crewmembers who made ideal winter-over candidates, and self-reported depressive symptoms. Social/demographic characteristics, personality traits, interpersonal needs, and characteristics of station environments collectively accounted for 9-17% of the variance in performance measures. The following characteristics were significant independent predictors of more than one performance measure: military service, low levels of neuroticism, extraversion and conscientiousness, and a low desire for affection from others. These results represent an important first step in the development of select-in criteria for personnel on long-duration missions in space and other extreme environments. These criteria must take into consideration the characteristics of the environment and the limitations they place on meeting needs for interpersonal relations and task performance, as well as the characteristics of the individuals and groups who live and work in these environments.

Author

Antarctic Regions; Human Performance; Human Relations; Performance Prediction; Personality; Personnel; Psychology; Psychological Effects; Human Reactions

Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..

20000068483 NASA Marshall Space Flight Center, Huntsville, AL USA

International Space Station Sustaining Engineering: A Ground-Based Test Bed for Evaluating Integrated Environmental Control and Life Support System and Internal Thermal Control System Flight Performance

Ray, Charles D., NASA Marshall Space Flight Center, USA; Perry, Jay L., NASA Marshall Space Flight Center, USA; Callahan, David M., ION Corp., USA; [2000]; 31p; In English; 30th; 7th; Environmental Systems, 10-13 Jul. 2000, Toulouse, Toulouse, France, France; Sponsored by Society of Automotive Engineers, Inc., USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As the International Space Station's (ISS) various habitable modules are placed in service on orbit, the need to provide for sustaining engineering becomes increasingly important to ensure the proper function of critical onboard systems. Chief among these are the Environmental Control and Life Support System (ECLSS) and the Internal Thermal Control System (ITCS). Without either, life onboard the ISS would prove difficult or nearly impossible. For this reason, a ground-based ECLSS/ITCS hardware performance simulation capability has been developed at NASA's Marshall Space Flight Center. The ECLSS/ITCS Sustaining Engineering Test Bed will be used to assist the ISS Program in resolving hardware anomalies and performing periodic performance assessments. The ISS flight configuration being simulated by the test bed is described as well as ongoing activities related to its preparation for supporting ISS Mission 5A. Growth options for the test facility are presented whereby the current facility may be upgraded to enhance its capability for supporting future station operation well beyond Mission 5A. Test bed capabilities for demonstrating technology improvements of ECLSS hardware are also described.
Author

Ground Tests; Test Facilities; Environmental Control; Life Support Systems; Simulation; Flight Characteristics

20000068484 NASA Marshall Space Flight Center, Huntsville, AL USA

International Space Station USA Oxygen Generator Development Testing

Erickson, Robert J., NASA Marshall Space Flight Center, USA; Mason, Richard K., Hamilton Sundstrand Space Systems International, Inc., USA; [2000]; 5p; In English; 30th; Environmental Systems, 10-13 Jul. 2000, Toulouse, France; Sponsored by Society of Automotive Engineers, Inc., USA

Report No.(s): ICES Paper 2000-0232; Copyright; Avail: Issuing Activity

A life test of a liquid anode feed oxygen generator assembly (OGA) using SPE(R) (United Technologies Corporation, Hamilton Sundstrand Division) membrane technology was terminated in June of 1999. In the total 15,658 hours of operation at MSFC since delivery in 1995, the OGA has produced 2,103 kilograms (kg) (4,632 pounds mass (lbm)) of oxygen, and 263 kg (579 lbm) of hydrogen. Evaluation of cell stack characteristics and oxygen and hydrogen hydrophilic/hydrophobic membrane separators will be discussed.
Author

Anodes; Liquid Oxygen; Life (Durability); Performance Tests; Electric Generators

20000069779 National Defence Research Establishment, Div. of Human Sciences, Linkoeping, Sweden

Digital Human Modeling Conference *Digital Human Modeling Conference Haag, Maj 1999*

Hoerberg, U.; Soederberg, H.; May 1999; 26p; In Swedish, May 1999, The Hague, Netherlands

Report No.(s): PB2000-103064; FOA-R-99-01153-706-SE; No Copyright; Avail: National Technical Information Service (NTIS)

The journey's purpose was to participate in the Digital Human Modeling Conference. At the conference, the following eight themes were presented. They were 'Application of Human Modeling', '3-D Anthropometry Measuring Methods and Parametric Approaches for Human Modeling', 'Think Before You Leap; Modeling Human Behavior', 'Verification and Validation of Human Models', 'Biomechanics and Human Strength Simulation', 'Human Motion and Posture Measurement', 'Human Modeling and Engineering' and 'Development of Virtual Human-Centered Engineering Systems'. The report contains reviews and comments about the sessions and the exhibition.
NTIS

Digital Systems; Anthropometry; Human Behavior; Simulation

20000069846 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

USA Navy Advanced Crew Station Evaluation Techniques

Crawford, Jennifer; Jun. 2000; 11p; In English

Report No.(s): AD-A377911; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

 The U.S. Navy is tasked to perform a baseline accommodation assessment of in-service Navy and Marine. The requirement to advance the technical processes used in defining the interior confines of crew stations for the purpose of assessing accommodation issues is included in the program task. A new methodology has been developed by the U.S. Navy that utilizes advanced data collection technology and data analysis techniques. This set of procedures is called the Navy Advanced Crew Station Evaluation Technique (NACSET) which can be applied to any crew or work station. The evaluation investigates accommodation issues such as head, leg, and knee clearance, eye position, and reach ability. The analysis produces accommodation prediction equations for each issue under investigation. The prediction equations arc used to develop three products: Percent Accommodated, the Individual Screening Process, and Anthropometric Restriction Codes for the USN and USMC. NACSET provides methods for not only evaluating current crew stations, but also crew stations currently under design. NACSET methods are also easily adaptable to fit a program's specific needs.

DTIC

Anthropometry; Crew Workstations

20000069847 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

USN/USMC Ejection Seat Equipped Aircraft Anthropometric Accommodation

Kennedy, Greg; Jan. 1999; 14p; In English

Report No.(s): AD-A377912; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

 USN/USMC ejection Seat equipped aircraft anthropometric accommodation guidance is outdated and undocumented. Recent reassignments of aviators within the USN/USMC have highlighted an area where operational dollars could be saved by assigning candidate aviators to a correct and safe pipeline. These issues were revealed during the course of NAVAIRSYSCOM (PMA-202) Aircrew Accommodation Expansion Program where AIR 4.6, Patuxent River was tasked to perform a baseline accommodation assessment of in-service USN/USMC aircraft. The methods used in the program approach were different than procedures historically used to determine USN/USMC aviator suitability and to verify cockpit design. A multivariate statistical approach was employed and served as the basis for determining the safe accommodation envelope. The revised guidance suggested here accounts for: (1) The location of the scat with respect to the competing variables that drive the seat location; (2) The operational use of the anthropometric accommodation guidance and pipeline relational charting; and (3) The cost avoidance associated with inappropriately assigning aviators. These revised guides help to define the acceptable range of aircrew anthropometric dimensions that must be satisfied to achieve safety of flight and mission of effectiveness.

DTIC

Aircraft; Ejection Seats; Anthropometry; Multivariate Statistical Analysis; Aircraft Pilots

20000070335 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Helicopter Aircrew Integrated Life Support System (HAILSS) Aircraft Integration Tests

Reason, William; Apr. 1999; 6p; In English

Report No.(s): AD-A377892; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

 The Helicopter Aircrew Integrated Life Support System (HAILSS) ensemble is an impermeable coverall designed for protection in the Chemical and Biological threat arena. Additionally, the garment can be used as an anti-exposure system because the impermeable fabric effectively makes the garment a dry suit. It has booties sewn and sealed at the ankles and butyl rubber neck and wrist seals. The system employs a mesh spacer material that provides for conditioned air flow through the garment with one-way check valves on each lower sleeve for conditioned air exhaust. The entire ensemble is worn over a skin tight moisture wicking underwear. The systems is provided with protective head gear including a modified HGU-56/P two-part helmet with an integrated hood that provides for goggle demisting and aviator respiration.

DTIC

Life Support Systems; Aircraft Pilots; Systems Integration

20000072480 National Inst. of Standards and Technology, (BFRL), Gaithersburg, MD USA

Estimates of Thermal Conductivity for Materials Used in Fire Fighters' Protective Clothing

Lawson, J. R.; Pinder, T. A.; May 2000; 30p; In English

Report No.(s): PB2000-105986; NISTIR-6512; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Fire fighters' protective clothing provides a limited amount of thermal protection from environmental exposures produced by fires. This level of thermal protection varies with the design, materials, construction, and fit of the protective garments. This report presents thermal conductivity data for nine materials used in fabricating fire fighters' protective clothing. These materials included outer shell fabrics, moisture barrier, thermal linear batting, and reflective trim. As a comparison, measurements were also made on a cotton duck fabric. The thermal conductivity of individual protective clothing materials was measured using the test procedure specified in ASTM C-518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus (1). Measurements producing estimates of thermal conductivity for single layers of materials were carried out at mean heat temperatures of 20 deg C (68 deg F), 48 C (118 F), 55 deg C (131 F), and 72 C (162 F). No visible physical changes were observed with any of the materials tested at these temperatures. Thermal conductivity estimates for materials used in the construction of fire fighters' protective clothing ranged from 0.034 W/mK to 0.136 W/mK over the range of temperatures addressed in the study. Generally, thermal conductivity values increased for all materials as mean test temperatures were increased.
NTIS

Estimates; Protective Clothing; Thermal Conductivity; Fire Fighting; Thermal Protection

20000072483 NASA Marshall Space Flight Center, Huntsville, AL USA
Living and Working in Space
Roman, Monserrate C., NASA Marshall Space Flight Center, USA; [2000]; 30p; In English; 2000 National Image, Inc., Training Conference and Convention, 6-11 Jun. 2000, Carolina, Puerto Rico; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document is a presentation about some of the challenges of living and working in space. The presentation shows slides of the Apollo 11 liftoff, Skylab in orbit, a Space Shuttle launch, and a slide of the International Space Station. It reviews the needs and effluents of the astronauts per day, and the Environmental Control and Life Support (ECLS) systems. It shows a flow diagram of the Space Station Regenerative ECLS, which shows the various systems, and how they interact to control the environment and recycle the air, and water. There are other slides some of which show astronauts eating, brushing teeth, shaving, and sipping from a sip bottle while exercising.
CASI

Environmental Control; Life Support Systems; Water; Closed Ecological Systems; Oxygen Supply Equipment; Spacecraft Environments; Waste Management; Oxygen Production; Waste Disposal

20000072884 NASA Marshall Space Flight Center, Huntsville, AL USA
International Space Station Carbon Dioxide Removal Assembly Testing
Knox, James C., NASA Marshall Space Flight Center, USA; 2000; ISSN 0148-7191; 13p; In English; 30th; Environmental Systems, 10-13 Jul. 2000, Toulouse, France; Sponsored by Society of Automotive Engineers, Inc., USA
Report No.(s): 00ICES-234; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Performance testing of the International Space Station Carbon Dioxide Removal Assembly flight hardware in the USA Laboratory during 1999 is described. The CDRA exceeded carbon dioxide performance specifications and operated flawlessly. Data from this test is presented.
Author

Carbon Dioxide Removal; International Space Station; Performance Tests; Decontamination; Closed Ecological Systems; Exobiology; Spacecraft Environments; Spacecraft Equipment

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see 52 Aerospace medicine; on animals and plants see 51 Life Sciences. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science.

20000068529 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Integrated Microchemical Analysis System Using DS2 Penetrator Technology for the Enantiomeric Detection of Amino Acids
Grunthaner, Frank J., Jet Propulsion Lab., California Inst. of Tech., USA; Bada, Jeffrey L., California Univ., San Diego, USA; Mathies, Richard, California Univ., USA; Hutt, Lester, California Univ., USA; Grunthaner, Paula, Jet Propulsion Lab., California Inst. of Tech., USA; Grannan, Sabrina, Jet Propulsion Lab., California Inst. of Tech., USA; Lin, Gisela, Jet Propulsion Lab., California Inst. of Tech., USA; Blaney, Diana L., Jet Propulsion Lab., California Inst. of Tech., USA; McDonald, Gene, Jet Propulsion

Lab., California Inst. of Tech., USA; Becker, Luann, Hawaii Univ., USA; [1996]; 2p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Any strategy for investigating whether abiotic and/or biotic organic molecules are present on Mars and the search for biosignatures should focus on compounds which are readily synthesized under plausible prebiotic conditions, play an essential role in biochemistry as we know it and have properties such as chirality (handedness) which can be used to distinguish between abiotic vs. biotic origins (1). Amino acids are one of the few compound classes that fulfill all these requirements. They are synthesized in high yields in prebiotic simulation experiments, are one of the more abundant types of organic compounds present in carbonaceous meteorites and only the L-enantiomers are used in the proteins and enzymes in life on Earth.
Derived from text
Biochemistry; Amino Acids; Organic Compounds; Microanalysis; Enantiomers

20000073302 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Different Approaches for Ensuring Performance/Reliability of Plastic Encapsulated Microcircuits (PEMs) in Space Applications

Gerke, R. David, Jet Propulsion Lab., California Inst. of Tech., USA; Sandor, Mike, Jet Propulsion Lab., California Inst. of Tech., USA; Agarwal, Shri, Jet Propulsion Lab., California Inst. of Tech., USA; Moor, Andrew F., Jet Propulsion Lab., California Inst. of Tech., USA; Cooper, Kim A., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 23p; In English; 1999 Interpack Conference, 17 Jun. 1999, USA; Sponsored by American Society of Mechanical Engineers, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents viewgraphs on Plastic Encapsulated Microcircuits (PEMs). Different approaches are addressed to ensure good performance and reliability of PEMs. The topics include: 1) Mitigating Risk; and 2) Program results.
CASI
Encapsulated Microcircuits; Technology Utilization; Plastics; Performance Tests; Reliability

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see categories 60 through 67.

20000069366 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden

New Bounds on the Lieb-Thirring Constants

Hundertmark, D.; Laptev, A.; Weidl, T.; Jun. 1999; 22p; In English

Report No.(s): PB2000-103209; TRITA-MAT-99-MA-13; No Copyright; Avail: National Technical Information Service (NTIS)

Improved estimates on the constants L(sub y,d), for 1/2 less than gamma less than 3/2, d approximately N in the inequalities for the eigenvalue moments of Schrodinger operators are established.
NTIS
Eigenvalues; Inequalities; Schroedinger Equation

20000069367 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden

Best Approximation in the Supremum Norm by Analytic and Harmonic Functions

Khavinson, D.; Shapiro, H. S.; Jun. 1999; 28p; In English

Report No.(s): PB2000-103211; TRITA-MAT-99-MA-11; No Copyright; Avail: National Technical Information Service (NTIS)

In this paper, the authors study the problem of finding, for a given bounded measurable function f on a domain omega in R(sup n), a harmonic function on omega that best approximates f in the supermum norm, as well as (when n = 2) the corresponding problem of approximating a bounded measurable function on the boundary of a plane domain (especially, the unit disk) by the boundary values of bounded analytic functions in the interior has been studied very extensively, but the present problem (which, as we shall see, is quite different in character) has received very little attention. There have been some studies, by Luecking (Lu1, Lu2), Hintzman (Hi1, Hi2) and Romanova (Ro1, Ro2), pertaining to approximation by analytic functions.
NTIS
Analytic Functions; Harmonic Functions; Theorems

20000070516 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France

Symplectic Groupoid of Triangular Bilinear Forms and the Braid Group

Bondal, A.; Jan. 2000; 70p; In English

Report No.(s): PB2000-106156; IHES/M/00/02; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

This paper arises as a result of efforts aimed to understand and study a surprising Poisson bracket P, found by the author in 1995, on the space A of bilinear forms which have an upper triangular matrix with ones along the diagonal. The forms are defined on an n-dimensional vector space V over a field k.

NTIS

Group Theory; Algebra; Triangles; Geometry

20000072567 Royal Inst. of Tech., Dept. of Mathematics, Stockholm, Sweden

Smooth Modules over Lie Algebroids

Kaellstroem, R.; May 1999; ISSN 1401-2278; 82p; In English

Report No.(s): PB2000-103213; TRITA-MAT-99-MA-09; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

Contents include following: Lie algebroids; modules coherence of direct images and duality; smooth modules; and GAGA and holonomic modules.

NTIS

Algebra; Images; Coherent Radiation

20000073394 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Travel time Inversion Using Two Point Ray Tracing

Kim, W. H.; Ham, I. K.; Oct. 31, 1997; 46p; In Korean; In English

Report No.(s): DE99-727796; KAERI-CM-175/96; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this study is to develop the travel time inverse algorithm using two point ray tracing. This method will apply to several different models to understand the characteristics of the method and to solve the problems and limitation of the method and the models. This study will introduce two point ray tracing and its application to the travel time inversion. The horizontal distance between the source and receiver can be described as an analytical forms using the Snell's law when the velocities of horizontal layers are given as constant or linearly varying function. The initial take-off angle which gives two point ray tracing is obtained from numerical method, although the equation of horizontal distance with respect to the initial take-off angle is non-liner. The inverse algorithm are $(Delta)T(sub i) = G(sub ij) (Delta)V(sub j)$ where $(Delta)T(sub i)$ is i-th ray travel time difference difference between the calculated and observed travel times, and $G(sub ij)$ is the ray-length of i-th ray in the j-th layer, and $(Delta)V(sub j)$ is the j-th layer velocity difference between given and true velocities. The iterations are continued until that the $(Delta)T$ is small enough to satisfy the desired accuracy. The two point ray tracing is accurately calculated when the velocities of layered media are given as constant or linear. The computational results of traveltime inversion shows accurate and efficient methods, and also rapid convergence without depending on the given initial values. However, the accuracy of this method depends on the accuracy of the data, further study required to solve these problems.

Author(NTIS)

Mathematical Logic; Time Functions; Algorithms; Ray Tracing; Inversions

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see 33 Electronics and Electrical Engineering. For computer vision see 63 Cybernetics, Artificial Intelligence and Robotics.

20000068535 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Toward Evolvable Hardware Chips: Experiments with a Programmable Transistor Array

Stoica, Adrian, Jet Propulsion Lab., California Inst. of Tech., USA; [1998]; 7p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Evolvable Hardware is reconfigurable hardware that self-configures under the control of an evolutionary algorithm. We search for a hardware configuration can be performed using software models or, faster and more accurate, directly in reconfigurable hardware. Several experiments have demonstrated the possibility to automatically synthesize both digital and analog circuits. The paper introduces an approach to automated synthesis of CMOS circuits, based on evolution on a Programmable Transistor Array (PTA). The approach is illustrated with a software experiment showing evolutionary synthesis of a circuit with a desired

DC characteristic. A hardware implementation of a test PTA chip is then described, and the same evolutionary experiment is performed on the chip demonstrating circuit synthesis/self-configuration directly in hardware.
Author
Chips; Analog Circuits; Algorithms; Hardware

20000068926 Norwegian Defence Research Establishment, Kjeller, Norway
Pipelined 128-Point Radix 2 FFT Processor *Pipelinet 128-Punkters Radix-2 FFT-Prosessor. Med Vektorlengdeuavhengig Ytelse of Full Utnyttelse av Aritmetiske Enheter*
Blom, Harald, Norwegian Defence Research Establishment, Norway; Gundersen, Rune, Norwegian Defence Research Establishment, Norway; Feb. 10, 2000; 280p; In Norwegian; Original contains color illustrations
Contract(s)/Grant(s): Proj. FFIE/726/170
Report No.(s): FFI/RAPPORT-2000/00885; ISBN 82-464-0409-1; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche
    This report contains a description of a pipelined 128-points radix-2 FFT-processor. The performance of the processor is independent of vector length. The arithmetic units are fully utilized. The design is consistent with IEEE-754 standard for binary floating-point arithmetic. It is fully tested and verified. Synthesis results for the Alcatel Mietec MTC45000 technology are presented.
Author
Arithmetic and Logic Units; Fast Fourier Transformations; Source Programs

20000070441 California Inst. of Tech., Pasadena, CA USA
Holographic 3D Disks *Final Report, 1 Jun 1996-31 May 1999*
Psaltis,, California Inst. of Tech., USA; Jan. 2000; 250p; In English
Contract(s)/Grant(s): F49620-96-1-0196; AF Proj. 2305
Report No.(s): AD-A377847; AFRL-SR-BL-TR-00-0175; No Copyright; Avail: CASI; A03, Microfiche; A11, Hardcopy
    The optical correlator and the holographic database can be miniaturized to fit in small places such as onboard a vehicle, missile or in the walls of a building as self contained units.
DTIC
Holography; Miniaturization; Optical Correlators; Data Storage

20000070472 ViA, Inc., Burnsville, MN USA
Wrist Interactive Device for Wearable PC *Monthly Report, 1-30 Apr. 2000*
Dini, Paolo, ViA, Inc., USA; May 12, 2000; 8p; In English
Contract(s)/Grant(s): N00421-97-C-1293
Report No.(s): AD-A377604; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy
    This report is an update outlining the monthly progress of the development of a wrist interactive device for a wearable PC.
DTIC
Wrist; Personal Computers; Human-Computer Interface

20000072576 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Extending the Computer Revolution into Space
Deutsch, Leslie J., Jet Propulsion Lab., California Inst. of Tech., USA; Apr. 12, 1999; 49p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    The computer revolution is far from over on Earth. It is just beginning in space. We can look forward to an era of enhanced scientific exploration of the solar system and even other start systems. We can look forward to the benefits of this space revolution to commercial uses on and around Earth.
Derived from text
Space Exploration; Computer Design; Product Development; Computer Techniques

20000073246 NASA Goddard Space Flight Center, Greenbelt, MD USA
New Human-Computer Interface Concepts for Mission Operations
Fox, Jeffrey A., Pacific Northwest National Lab., USA; Hoxie, Mary Sue, Pacific Northwest National Lab., USA; Gillen, Dave, Pacific Northwest National Lab., USA; Parkinson, Christopher, Pacific Northwest National Lab., USA; Breed, Julie, NASA Goddard Space Flight Center, USA; Nickens, Stephanie, NASA Goddard Space Flight Center, USA; Baitinger, Mick, NEXGEN Solutions, Inc., USA; [2000]; 10p; In English; SpaceOps, 19-23 Jun. 2000, Toulouse, France; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The current climate of budget cuts has forced the space mission operations community to reconsider how it does business. Gone are the days of building one-of-kind control centers with teams of controllers working in shifts 24 hours per day, 7 days per week. Increasingly, automation is used to significantly reduce staffing needs. In some cases, missions are moving towards lights-out operations where the ground system is run semi-autonomously. On-call operators are brought in only to resolve anomalies. Some operations concepts also call for smaller operations teams to manage an entire family of spacecraft. In the not too distant future, a skeleton crew of full-time general knowledge operators will oversee the operations of large constellations of small spacecraft, while geographically distributed specialists will be assigned to emergency response teams based on their expertise. As the operations paradigms change, so too must the tools to support the mission operations team's tasks. Tools need to be built not only to automate routine tasks, but also to communicate varying types of information to the part-time, generalist, or on-call operators and specialists more effectively. Thus, the proper design of a system's user-system interface (USI) becomes even more importance than before. Also, because the users will be accessing these systems from various locations (e.g., control center, home, on the road) via different devices with varying display capabilities (e.g., workstations, home PCs, PDAS, pagers) over connections with various bandwidths (e.g., dial-up 56k, wireless 9.6k), the same software must have different USIs to support the different types of users, their equipment, and their environments. In other words, the software must now adapt to the needs of the users! This paper will focus on the needs and the challenges of designing USIs for mission operations. After providing a general discussion of these challenges, the paper will focus on the current efforts of creatin(y an effective USI for one specific suite of tools, SERS (The Spacecraft Emergency Response System), which has been built to enable lights-out operations. SERS is a Web-based collaborative environment that enables secure distributed fault management.
Author
Human-Computer Interface; Communication Networks; Workstations; Space Missions; Aerospace Vehicles

20000073251 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Export Controls: Challenges and Changes For Controls on Computer Exports
Johnson, HArold J.; May 26, 2000; 18p; In English; Testimony: Before Governmental Affairs Committee, U.S. Senate
Report No.(s): AD-A377861; GAO/T-NSIAD-00-187; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

I am pleased to be here today to discuss export controls for high performance computers. My testimony is based on work that we have conducted over the past 3 years, particularly the reports we issued in 1998 and 1999. U.S. policy with respect to the export of sensitive technology, including computers, is to seek a balance between the U.S. economic interest in promoting exports and its national security interests in both maintaining a military advantage over potential adversaries and denying the spread of technologies used in developing weapons of mass destruction. The USA has long controlled the export of high performance computers to sensitive destinations, such as Russia and China. These computers have both civilian (dual use) and military applications and technological advancements in computing power have been rapid. The Department of Commerce has primary responsibility for managing the licensing of these dual-use items and weighing the promotion of commercial interests in exporting items against the protection of national security interests. For the past several years, there has been continuing congressional concern about and debate over whether our national security is being harmed by relaxing export controls on high performance computers and over the rationale for subsequent revised controls.
DTIC
International Trade; Supercomputers; Procurement; Security; USA

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20000068916 MRJ Technology Solutions, Moffett Field, CA USA
Portable Parallel Programming for the Dynamic Load Balancing of Unstructured Grid Applications
Biswas, Rupak, MRJ Technology Solutions, USA; Das, Sajal K., University of North Texas, USA; Harvey, Daniel, University of North Texas, USA; Oliker, Leonid, Research Inst. for Advanced Computer Science, USA; [1999]; 6p; In English; International Parallel Processing, 12-16 Apr. 1999, San Juan, Puerto Rico
Contract(s)/Grant(s): NAS2-14303; NAS2-96027; TARP-97-003594-013; RTOP 519-40-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The ability to dynamically adapt an unstructured -rid (or mesh) is a powerful tool for solving computational problems with evolving physical features; however, an efficient parallel implementation is rather difficult, particularly from the view point of

portability on various multiprocessor platforms We address this problem by developing PLUM, tin automatic anti architecture-independent framework for adaptive numerical computations in a message-passing environment. Portability is demonstrated by comparing performance on an SP2, an Origin2000, and a T3E, without any code modifications. We also present a general-purpose load balancer that utilizes symmetric broadcast networks (SBN) as the underlying communication pattern, with a goal to providing a global view of system loads across processors. Experiments on, an SP2 and an Origin2000 demonstrate the portability of our approach which achieves superb load balance at the cost of minimal extra overhead.

Author

Parallel Programming; Dynamic Loads; Balancing; Unstructured Grids (Mathematics)

20000068918 NASA Ames Research Center, Moffett Field, CA USA

Model Checking JAVA Programs Using Java Pathfinder

Havelund, Klaus, NASA Ames Research Center, USA; Pressburger, Thomas, NASA Ames Research Center, USA; [2000]; 17p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes a translator called JAVA PATHFINDER from JAVA to PROMELA, the "programming language" of the SPIN model checker. The purpose is to establish a framework for verification and debugging of JAVA programs based on model checking. This work should be seen in a broader attempt to make formal methods applicable "in the loop" of programming within NASA's areas such as space, aviation, and robotics. Our main goal is to create automated formal methods such that programmers themselves can apply these in their daily work (in the loop) without the need for specialists to manually reformulate a program into a different notation in order to analyze the program. This work is a continuation of an effort to formally verify, using SPIN, a multi-threaded operating system programmed in Lisp for the Deep-Space 1 spacecraft, and of previous work in applying existing model checkers and theorem provers to real applications.

Author

Java (Programming Language); Program Verification (Computers); Concurrent Processing

20000068920 NASA Ames Research Center, Moffett Field, CA USA

On the Use of CAD-Native Predicates and Geometry in Surface Meshing

Aftosmis, M. J., NASA Ames Research Center, USA; [1999]; 12p; In English; Integration of CAD and CFD, 12-13 Apr. 1999, Davis, CA, USA; Sponsored by Society for Industrial and Applied Mathematics, USA

Contract(s)/Grant(s): RTOP 522-31-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Several paradigms for accessing CAD geometry during surface meshing for CFD are discussed. File translation, inconsistent geometry engines and non-native point construction are all identified as sources of non-robustness. The paper argues in favor of accessing CAD parts and assemblies in their native format, without translation, and for the use of CAD-native predicates and constructors in surface mesh generation. The discussion also emphasizes the importance of examining the computational requirements for exact evaluation of triangulation predicates during surface meshing. The native approach is demonstrated through an algorithm for the generation of closed manifold surface triangulations from CAD geometry. CAD parts and assemblies are used in their native format, and a part's native geometry engine is accessed through a modeler-independent application programming interface (API). In seeking a robust and fully automated procedure, the algorithm is based on a new physical space manifold triangulation technique specially developed to avoid robustness issues associated with poorly conditioned mappings. In addition, this approach avoids the usual ambiguities associated with floating-point predicate evaluation on constructed coordinate geometry in a mapped space. The technique is incremental, so that each new site improves the triangulation by some well defined quality measure. The algorithm terminates after achieving a prespecified measure of mesh quality and produces a triangulation such that no angle is less than a given angle bound, a or greater than pi - 2alpha. This result also sets bounds on the maximum vertex degree, triangle aspect-ratio and maximum stretching rate for the triangulation. In addition to the output triangulations for a variety of CAD parts, the discussion presents related theoretical results which assert the existence of such an angle bound, and demonstrate that maximum bounds of between 25 deg and 30 deg may be achieved in practice.

Author

Computer Aided Design; Computational Geometry; Surface Stability; Computational Fluid Dynamics; Grid Generation (Mathematics); Computational Grids; Mathematical Models

20000068972 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Matpar Server on the HP Exemplar

Springer, Paul, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 20p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This presentation reviews the design of Matlab for parallel processing on a parallel system. Matlab was found to be too slow on many large problems, and with the Next Generation Space Telescope requiring greater capability, the work was begun in early 1996 on parallel extensions to Matlab, called Matpar. This presentation reviews the architecture, the functionality, and the design of MatPar. The design utilizes a client server strategy, with the client code written in C, and the object-oriented server code written in C++. The client/server approach for Matpar provides ease of use an good speed.
CASI

Parallel Processing (Computers); Matrices (Mathematics); Response Time (Computers)

20000069002 NASA Ames Research Center, Moffett Field, CA USA
Practical Application of Model Checking in Software Verification
Havelund, Klaus, NASA Ames Research Center, USA; Skakkebaek, Jens Ulrik, Stanford Univ., USA; [1999]; 22p; In English
Contract(s)/Grant(s): NAG2-891; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    This paper presents our experiences in applying the JAVA PATHFINDER (J(sub PF)), a recently developed JAVA to SPIN translator, in the finding of synchronization bugs in a Chinese Chess game server application written in JAVA. We give an overview of J(sub PF) and the subset of JAVA that it supports and describe the abstraction and verification of the game server. Finally, we analyze the results of the effort. We argue that abstraction by under-approximation is necessary for abstracting sufficiently smaller models for verification purposes; that user guidance is crucial for effective abstraction; and that current model checkers do not conveniently support the computational models of software in general and JAVA in particular.
Author

Mathematical Models; Program Verification (Computers); Computer Viruses

20000069004 MRJ Technology Solutions, Moffett Field, CA USA
Scheduling for Parallel Supercomputing: A Historical Perspective of Achievable Utilization
Jones, James Patton, MRJ Technology Solutions, USA; Nitzberg, Bill, MRJ Technology Solutions, USA; [1999]; 14p; In English; International Parallel Processing Symposium, 1999, Unknown
Contract(s)/Grant(s): NAS2-14303; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    The NAS facility has operated parallel supercomputers for the past 11 years, including the Intel iPSC/860, Intel Paragon, Thinking Machines CM-5, IBM SP-2, and Cray Origin 2000. Across this wide variety of machine architectures, across a span of 10 years, across a large number of different users, and through thousands of minor configuration and policy changes, the utilization of these machines shows three general trends: (1) scheduling using a naive FIFO first-fit policy results in 40-60% utilization, (2) switching to the more sophisticated dynamic backfilling scheduling algorithm improves utilization by about 15 percentage points (yielding about 70% utilization), and (3) reducing the maximum allowable job size further increases utilization. Most surprising is the consistency of these trends. Over the lifetime of the NAS parallel systems, we made hundreds, perhaps thousands, of small changes to hardware, software, and policy, yet, utilization was affected little. In particular these results show that the goal of achieving near 100% utilization while supporting a real parallel supercomputing workload is unrealistic.
Author

Supercomputers; Massively Parallel Processors; Computer Programs; Workloads (Psychophysiology)

20000069008 MRJ Technology Solutions, Moffett Field, CA USA
Fast Time-Varying Volume Rendering Using Time-Space Partition (TSP) Tree
Shen, Han–Wei, MRJ Technology Solutions, USA; Chiang, Ling–Jen, MRJ Technology Solutions, USA; Ma, Kwan–Liu, Institute for Computer Applications in Science and Engineering, USA; [1999]; 4p; In English; Visualization, 24-29 Oct. 1999, San Francisco, CA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-72; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
    We present a new, algorithm for rapid rendering of time-varying volumes. A new hierarchical data structure that is capable of capturing both the temporal and the spatial coherence is proposed. Conventional hierarchical data structures such as octrees are effective in characterizing the homogeneity of the field values existing in the spatial domain. However, when treating time merely as another dimension for a time-varying field, difficulties frequently arise due to the discrepancy between the field's spatial and temporal resolutions. In addition, treating spatial and temporal dimensions equally often prevents the possibility of detecting the coherence that is unique in the temporal domain. Using the proposed data structure, our algorithm can meet the following goals. First, both spatial and temporal coherence are identified and exploited for accelerating the rendering process. Second, our algorithm allows the user to supply the desired error tolerances at run time for the purpose of image-quality/rendering-speed trade-off.

Third, the amount of data that are required to be loaded into main memory is reduced, and thus the I/O overhead is minimized. This low I/O overhead makes our algorithm suitable for out-of-core applications.
Author

Algorithms; Time; Variations; Hierarchies; Data Structures

20000069222 NASA Goddard Space Flight Center, Greenbelt, MD USA

Proceedings of the Twenty-Fourth Annual Software Engineering Workshop

March 2000; 570p; In English; 24th; Software Engineering, 1-2 Dec. 1999, Greenbelt, MD, USA; See also 20000069223 through 20000069243; Original contains color illustrations

Contract(s)/Grant(s): IDIQ5-2857-G

Report No.(s): NASA/CP-2000-209890; Rept-2000-01799-0; SEL-99-002; NAS 1.55:209890; No Copyright; Avail: CASI; C01, CD-ROM; A04, Microfiche; A24, Hardcopy

On December 1 and 2, the Software Engineering Laboratory (SEL), a consortium composed of NASA/Goddard, the University of Maryland, and CSC, held the 24th Software Engineering Workshop (SEW), the last of the millennium. Approximately 240 people attended the 2-day workshop. Day 1 was composed of four sessions: International Influence of the Software Engineering Laboratory; Object Oriented Testing and Reading; Software Process Improvement; and Space Software. For the first session, three internationally known software process experts discussed the influence of the SEL with respect to software engineering research. In the Space Software session, prominent representatives from three different NASA sites- GSFC's Marti Szczur, the Jet Propulsion Laboratory's Rick Doyle, and the Ames Research Center IV&V Facility's Lou Blazy- discussed the future of space software in their respective centers. At the end of the first day, the SEW sponsored a reception at the GSFC Visitors' Center. Day 2 also provided four sessions: Using the Experience Factory; A panel discussion entitled "Software Past, Present, and Future: Views from Government, Industry, and Academia"; Inspections; and COTS. The day started with an excellent talk by CSC's Frank McGarry on "Attaining Level 5 in CMM Process Maturity." Session 2, the panel discussion on software, featured NASA Chief Information Officer Lee Holcomb (Government), our own Jerry Page (Industry), and Mike Evangelist of the National Science Foundation (Academia). Each presented his perspective on the most important developments in software in the past 10 years, in the present, and in the future.
Author

Software Engineering; Conferences; Computer Programming; Computer Programs

20000069223 Tokheim, Ridderkerk, Netherlands

Experiences in Using the Goal/Question/Metric Paradigm

vanSolingen, Rini, Tokheim, Netherlands; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 14p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Tokheim, a company that provides products and services for the retail petroleum market, applies the Goal/Question/Metric paradigm to support their software development projects in their central development site in the Netherlands since 1994. Many experiences have been gathered during these projects. Experiences includes knowledge on software development topics, but also on practical GQM application in industry. The presentation will address a selection of experiences, lessons learned and measurement examples collected during the past years.
Author

Software Engineering; Computer Programming; Computer Programs; Industrial Plants; Process Control (Industry)

20000069224 Kaiserslautern Univ., Computer Science Dept., Germany

EXPERIMENTATION: Engine for Applied Research and Technology Transfer in Software Engineering

Rombach, Dieter, Kaiserslautern Univ., Germany; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 30p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The empirical work in NASA's Software Engineering Laboratory in the 70's and 80's has contributed significantly to the maturing of the sub-discipline of "experimental software engineering". The development of experimental technologies ranging from the GQM approach for measurement to the EF approach for organizational learning provided the scientific basis; the successful experiments within the SEL development environment served as successful reference examples for others. The Fraunhofer Institute for Experimental Software Engineering (IESE) was founded in Germany based on the successful SEL principles. It was charged with speeding up the transfer of innovative software engineering technologies into a wide variety of industry sectors. The concepts of experimentation were developed further and used for a wide range of purposes from applied research to technology transfer and training. Already during the short history of IESE a successful track record of transferring innovative

technologies fast and with sustained success has been established. This presentation focuses on the adaptation of the successful SEL concepts to a different environment, surveys the wide range of applications of "experiments" as engine for successful technology transfer in a human-based development environment, and predicts a growing importance of experimental work in the future.

Author

Computer Programming; Software Engineering; Technology Transfer; Computer Programs

20000069225 NASA Goddard Space Flight Center, Greenbelt, MD USA

Risk-Based Object Oriented Testing

Rosenberg, Linda H., NASA Goddard Space Flight Center, USA; Stapko, Ruth, Unisys Corp., USA; Gallo, Albert, Unisys Corp., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 26p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Software testing is a well-defined phase of the software development life cycle. Functional ("black box") testing and structural ("white box") testing are two methods of test case design commonly used by software developers. A lesser known testing method is risk-based testing, which takes into account the probability of failure of a portion of code as determined by its complexity. For object oriented programs, a methodology is proposed for identification of risk-prone classes. Risk-based testing is a highly effective testing technique that can be used to find and fix the most important problems as quickly as possible.

Author

Program Verification (Computers); Software Engineering; Software Reliability; Object Programs

20000069226 Software Architects, Inc., USA

Using Guided Inspection to Validate UML Models

Major, Melissa L., Software Architects, Inc., USA; McGregor, John D., Software Architects, Inc., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 25p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Guided inspection is an inspection/review technique that is "guided" by test cases. Inspections are used to provide a detailed examination of a design or program by a human, as opposed to a machine's execution of a prototype or completed application. However, even Fagan-style inspection processes focus more on the form of the inspection process rather than the substance of the material being inspected. Standard inspection techniques also focus on examining what is in the inspection material rather than determining whether there is something that is missing from the model or code. These standard inspections are often a top down reading of the code or a scan of a diagram. The top down approach makes the measurement of coverage straightforward but it is more difficult for the inspector to ensure that appropriate connections have been made between objects. The use of test cases means that the inspection process can address more than just the syntax of the diagram or code being reviewed. The test cases come from test plans that are already a required part of the software development process. Techniques such as checklists have been used to summarize the results of an inspection and to ensure that the inspector does a thorough job. Guided inspection supplements the checklist with the testing concept of "coverage". Coverage measures determine how much of the product being inspected has been examined. Test cases are selected from the test plan so that, for example, every use case is represented by at least one test case. Studies have reported widely varying savings ratios for finding faults early in the development process as opposed to during the compilation or system test phases. For example, IBM reported that repairing a fault found at system test time may cost as much as 100 times the cost of repairing the same fault found during design. With this amount of margin even a technique that is relatively expensive can still result in time and cost savings.

Author

Computer Programming; Software Engineering; Program Verification (Computers); Software Reliability

20000069227 Maryland Univ., Experimental Software Engineering Group, College Park, MD USA

Reading Techniques for OO Design Inspections

Travassos, Guilherme H., Maryland Univ., USA; Shull, Forrest, Maryland Univ., USA; Carver, Jeffrey, Maryland Univ., USA; Basili, Victor R., Maryland Univ., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 26p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Inspections can be used to identify defects in software artifacts. In this way, inspection methods help to improve software quality, especially when used early in software development. Inspections of software design may be especially crucial since design defects (problems of correctness and completeness with respect to the requirements, internal consistency, or other quality attributes) can directly affect the quality of, and effort required for, the implementation. We have created a set of "reading techniques" (so called because they help a reviewer to "read" a design artifact for the purpose of finding relevant information) that gives

specific and practical guidance for identifying defects in Object-Oriented designs. Each reading technique in the family focuses the reviewer on some aspect of the design, with the goal that an inspection team applying the entire family should achieve a high degree of coverage of the design defects. In this paper, we present an overview of this new set of reading techniques. We discuss the reading process and how readers can use these techniques to detect defects in high level object oriented design UML diagrams.
Author
Computer Programming; Object-Oriented Programming; Software Engineering; Software Reliability; Computer Programs

20000069228 Norwegian Univ. of Science and Technology, Trondheim, Norway
A Taxonomy of SPI Frameworks
Halvorsen, Christian Printzell, Norwegian Univ. of Science and Technology, Norway; Conradi, Reidar, Norwegian Univ. of Science and Technology, Norway; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 16p; In English; See also 20000069222; No Copyright; Avail: CASI; A03, Hardcopy

There exist a number of different approaches, often called frameworks, supporting software process improvement (SPI). Their differences and similarities has been the subject of some debate. This paper discusses four different classes of methods, which can be used to compare SPI frameworks. One of these methods is a new taxonomy proposed in this paper.
Author
Computer Programs; Software Engineering; Computer Programming; Taxonomy

20000069229 Master Systems, Inc., McLean, VA USA
Discipline of Market Leaders and Other Accelerators to Measurement
Rifkin, Stan, Master Systems, Inc., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 16p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

We often hear that it is difficult to get software measurement into practice. At least one important reason for this is that traditional software measurement is not aligned with the strategic objectives of the organization. When software measurement is aligned with an organization's market discipline then the implementation is accelerated.
Author
Software Engineering; Computer Programming; Software Reliability

20000069230 West Virginia Univ., Software Research Lab., Fairmont, WV USA
Software Measurement Frameworks to Assess the Value of Independent Verifications and Validation
Eickelmann, Nancy, West Virginia Univ., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 53p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A04, Hardcopy

Software IV&V, as practiced by the NASA IV&V Facility, is a well-defined, proven, systems engineering discipline designed to reduce risk in major software systems development. However, we currently have no proven methodology for estimating resource requirements for IV&V based on sound financial criteria. The quantification of a cost structure associated with IV&V and the resulting benefits are essential to make objective decisions concerning the allocation of resources to IV&V activities. The development of ROI metrics for NASA IV&V would provide key information to make rational budgetary decisions that impact safety and mission critical aspects of all NASA software systems. to measure IV&V benefits and costs we must identify relevant measures and provide target ranges for those measures that may be used to evaluate whether or not the goals are achieved and to what degree. This requires a measurement strategy for software IV&V in the NASA context. This paper presents the NASA IV&V Balanced Scorecard strategic measurement framework and discusses its role in providing a minimal and usable core metrics set.
Author
Software Engineering; Computer Programs; Software Reliability; Program Verification (Computers)

20000069231 NASA Ames Research Center, Moffett Field, CA USA
Software IV and V Research Priorities and Applied Program Accomplishments Within NASA
Blazy, Louis J., NASA Ames Research Center, USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 15p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The mission of this research is to be world-class creators and facilitators of innovative, intelligent, high performance, reliable information technologies that enable NASA missions to (1) increase software safety and quality through error avoidance, early detection and resolution of errors, by utilizing and applying empirically based software engineering best practices; (2) ensure

customer software risks are identified and/or that requirements are met and/or exceeded; (3) research, develop, apply, verify, and publish software technologies for competitive advantage and the advancement of science; and (4) facilitate the transfer of science and engineering data, methods, and practices to NASA, educational institutions, state agencies, and commercial organizations. The goals are to become a national Center of Excellence (COE) in software and system independent verification and validation, and to become an international leading force in the field of software engineering for improving the safety, quality, reliability, and cost performance of software systems. This project addresses the following problems: Ensure safety of NASA missions, ensure requirements are met, minimize programmatic and technological risks of software development and operations, improve software quality, reduce costs and time to delivery, and improve the science of software engineering

Derived from text

Computer Programming; Software Engineering; Computer Programs

20000069232 NASA Goddard Space Flight Center, Greenbelt, MD USA

Developing a Software Technology Roadmap to Enable NASA's 21st Century Missions

Szczur, Marti, NASA Goddard Space Flight Center, USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 17p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

   This paper contains the following sections: GSFC Space Missions of the 21st Century, Information Technology Challenges, Components of a GSFC Solution, and Conclusions.

Author

Computer Programs; Software Engineering; Information Systems

20000069233 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Impact of Autonomous Systems Technology on JPL Mission Software

Doyle, Richard J., Jet Propulsion Lab., California Inst. of Tech., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 16p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

   This paper discusses the following topics: (1) Autonomy for Future Missions- Mars Outposts, Titan Aerobot, and Europa Cryobot / Hydrobot; (2) Emergence of Autonomy- Remote Agent Architecture, Closing Loops Onboard, and New Millennium Flight Experiment; and (3) Software Engineering Challenges- Influence of Remote Agent, Scalable Autonomy, Autonomy Software Validation, Analytic Verification Technology, and Autonomy and Software Software Engineering.

Author

Computer Programming; Software Engineering; Computer Programs

20000069234 Computer Sciences Corp., Greenbelt, MD USA

Attaining Level 5 in CMM Process Maturity

McGarry, Frank, Computer Sciences Corp., USA; Decker, Bill, Computer Sciences Corp., USA; Haskell, Joe, Computer Sciences Corp., USA; Parra, Amy, Computer Sciences Corp., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 47p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

   In November 1998 the CSC SEAS Center achieved the rating of CMM Level 5 and became the sixth organization in the world to have ever attained that goal. The Capability Maturity Model (CMM) is a worldwide recognized benchmark of process maturity for software organizations and is used to assess the quality of an organization's software process. During the period covered by this study, the SEAS Center comprised approximately 850 personnel supporting systems engineering, software development, and analysis for NASA/GSFC. During the years of continually improving the processes toward the goal of attaining the level 5 rating, detailed information was recorded, tracked and analyzed so that subsequent efforts by other CSC organizations could benefit from the experiences of SEAS. This paper is a direct result of the collection and analysis of that process experience data. This paper begins with a brief overview of the SEAS organization that emphasizes the aggressive process improvement approach that has been in place since 1994. The paper will discuss the coordination of improvement initiatives, the role of goals and industry benchmarks, the organizational strategy and the use of key documents in measuring improvements. Additionally, the investment and benefits of an improvement program are discussed. Finally, based on the SEAS experience, the paper presents seven key factors that are the recommendations for any software organization undertaking an aggressive process improvement program.

Author

Software Engineering; Computer Programs; Software Development Tools; Computer Programming; Software Reliability

20000069235 Kaiserslautern Univ., Fraunhofer IESE, Germany
Lessons Learned from the Failure of an Experience Base Initiative Using a Bottom-Up Development Paradigm

Koennecker, Arne, Kaiserslautern Univ., Germany; Jeffery, Ross, New South Wales Univ., Australia; Low, Graham, New South Wales Univ., Australia; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 24p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes the development of an experience factory in an Australian organization. Information structures were well developed and used in the daily work of the organization. This included the use of network technology as well as the personal interaction between department members. Highly motivated personnel drove improvement via new techniques, knowledge, and tools. A special focus existed to simplify work tasks through tool support. Daily work and problem solving was strongly based on personnel interaction and access to knowledge bases (documentation, mail lists, etc.). The goal of the project was to package personnel experience and best practices and provide an effective framework for access and integration. The system was decommissioned shortly after the completion of the project. The reasons for this are discussed.
Author

Computer Programming; Computer Programs; Software Engineering; Real Time Operation

20000069236 Maryland Univ., College Park, MD USA
An Experience Management System for a Software Consulting Organization

Seaman, Carolyn, Maryland Univ. Baltimore County, USA; Mendonca, Manoel, Maryland Univ., USA; Basili, Victor, Maryland Univ., USA; Kim, Yong–Mi, Q-Labs., Inc., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 19p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Software is a major expense for most organizations and is on the critical path to almost all organizational activities. Individual software development organizations in general strive to develop higher quality systems at a lower cost for both their internal and external customers. Yet the processes used to develop such software are still very primitive in the way that experience is incorporated. Learning is often from scratch, and each new development team has to relearn the mistakes of its predecessors. Reuse of an organization's own products, processes, and experience is becoming more accepted as a feasible solution to this problem. But implementation of the idea, in most cases, has not gone beyond reuse of small-scale code components in very specific, well-defined, situations. True learning within a software development organization requires that organizational experiences, both technological and social, be analyzed and synthesized so that members of the organization can learn from them and apply them to new problems. Suppose, for example, that a member of a software development group is considering the use of a particular software engineering technology on a forthcoming project. This member has heard that this technology has been used successfully in other projects in some other part of the organization, but cannot easily find out where or by whom. He or she would like very much to learn from the experiences of those previous projects, first to help make the decision to use the technology or not, then to help implement the technology in the current project. It would be helpful, obviously, to avoid the inevitable mistakes that are made the first time a new technology is tried. Also, it would be useful to see the costs of using that technology (e.g. the costs of new tools or training) in order to help estimate those costs for the current project. Without the organizational infrastructure to support access to previous experience from within the organization, this type of information would be very difficult, if not impossible, for the development team member to get. This paper describes a system for supporting experience management in a multinational software improvement consultancy called Q-Labs. This Experience Management System (EMS) is based on the Experience Factory concept proposed by Basili. This paper focuses on describing the design principles behind EMS and reports the results of an evaluation of its interface.
Author

Computer Systems Programs; Software Engineering; Management Systems

20000069237 NASA, Washington, DC USA
Software Past, Present, and Future: Views from Government, Industry and Academia

Holcomb, Lee, NASA, USA; Page, Jerry, Computer Sciences Corp., USA; Evangelist, Michael, National Science Foundation, USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 22p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Views from the NASA CIO NASA Software Engineering Workshop on software development from the past, present, and future are presented. The topics include: 1) Software Past; 2) Software Present; 3) NASA's Largest Software Challenges; 4) 8330 Software Projects in Industry Standish Groups 1994 Report; 5) Software Future; 6) Capability Maturity Model (CMM): Software

Engineering Institute (SEI) levels; 7) System Engineering Quality Also Part of the Problem; 8) University Environment Trends Will Increase the Problem in Software Engineering; and 9) NASA Software Engineering Goals.
CASI
Software Development Tools; Governments; Industries; Software Engineering; NASA Programs

20000069238 Bull HN Information Systems, Inc., Phoenix, AZ USA

Quantitative Methods Do Work

Weller, Edward F., Bull HN Information Systems, Inc., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 18p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Quantitative methods, including statistical process control, can be effective tools for predicting and evaluating product quality during development and test. The data analysis and conclusions from applications of quantitative methods, including statistical process control, to two projects that were major components of a software release to Bull HN Information System's GCOS 8 Operating System, will show how these techniques were effective and useful. During development and test, we used the release quality predictions as one of the project metrics. We found that analysis of inspection and test results using SPC techniques helped us predict (perhaps understand is a better word) the release quality and the development processes controlling the release quality. We were able to answer the question "Can we ship this product?" with data rather than guesswork. Inspections have been used in GCOS 8 development since 1990. The process is stable and provides data used by project management. Our goal in the current release was to use defect density during development and test as input to predicting the post ship product quality with reasonable assurance. We are aware of the problems with using defects to predict failures, but in the absence of other data or usage based testing results, this was what we had to evaluate release quality.
Derived from text
Statistical Analysis; Information Systems; Process Control (Industry); Product Development

20000069239 Mitre Corp., USA

SEI CMM Level 4 Quantitative Analysis: Real Project Examples

Florence, Alfred W., Mitre Corp., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 47p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Software Engineering Institute's (SEI) Software (SW) Capability Maturity Model (CMM) Level 4 Quantitative Analysis leads into SW-CMM Level 5 activities. Level 4 Software Quality Management (SQM) Key Process Area (KPA) analysis, which focuses on product quality, feeds the activities required to comply with Defect Prevention (DP) at Level 5. Quantitative Process Management (QPM) at Level 4 focuses on the process which leads to Technology Change Management (TCM) and Process Change Management (PCM) at Level 5. At Level 3, metrics are collected, analyzed and used to status development and to make corrections to development efforts, as necessary. At Level 4, metrics are quantitatively analyzed to control process performance of the project and to develop a quantitative understanding of the quality of products to achieve specific quality goals. At Level 5, the Level 4 analysis is used, as appropriate, to investigate and incorporate new processes and technologies and for the prevention of defects. This paper presents the application of Statistical Process Control (SPC) in accomplishing the intent of SQM and QPM and applying the results to DP. Real project results are used to demonstrate the use of SPC as applied in a software setting. Presented are the processes that the author formulated, launched and conducted on a large software development effort. The organization had obtained SW-CMM Level 3 compliance and was pursuing Level 4 and Level 5. All Level 4 and Level 5 processes were installed and conducted on the project over a period of time. The main quantitative tool used was Statistical Process Control utilizing control charts. The project analyzed life cycle metrics collected during development for requirements, design, coding, integration, and during testing. Defects were collected during these life cycle phases and were quantitatively analyzed using statistical methods. The intent was to use this analysis to support the project in developing and delivering high quality products and at the same time using the information to make improvements, as required, to the development process.
Author
Computer Programs; Software Engineering; Process Control (Industry); Statistical Analysis

20000069240 Norwegian Univ. of Science and Technology, Trondheim, Norway

Empirical Study of Inspection and Testing Data at Ericsson, Norway

Conradi, Reidar, Norwegian Univ. of Science and Technology, Norway; Marjara, Amarjit Singh, Cap Gemini A.S., Norway; Skatevik, Borge, STC, Norway; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 48p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Inspections and testing represent core techniques to ensure reliable software. Inspections also seem to have a positive effect on predictability, total costs and delivery time. This paper presents a case study of inspections and testing, done at the Ericsson development department outside Oslo in Norway. This department develops and maintains customer-defined services around AXE phone switches, i.e. the functionality around the "star" and "square" buttons on house telephones. AXE development at Ericsson world-wide uses a simple, local experience database to record inspections and testing data. Two MSc students from NTNU have been given access to such historical data in 1997 and 1998. The results from these two diploma theses constitute the basis for this paper. The paper will study questions such as: 1) The effectiveness and cost-effectiveness of inspections, 2) The cost-effectiveness and defect profile of inspection meetings vs. individual reading, 3) The relation between complexity/modification-rate and defect density, 4) Whether the defect density for modules can be predicted from inspections for later phases and deliveries. The paper is organized as follows: Some relevant parts of the state of the art, especially of inspections, are summarized. First, the Ericsson context is described and then questions and hypotheses for the study are described. The organization of the study is described, and the results are discussed and presented. The paper is summed up and recommendations for future work are presented.

Author

Inspection; Norway; Software Engineering; Software Reliability; Performance Tests

20000069241 Connecticut Univ., Computer Science and Engineering Dept., Storrs, CT USA

JINI: A Technology for 21st Century. Is it Ready For Prime Time?

Demurjian, Steven A., Sr., Connecticut Univ., USA; Barr, Paul, Mitre Corp., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 31p; In English; See also 20000069222; Original contains color illustrations

Contract(s)/Grant(s): F49620-99-1-0244; No Copyright; Avail: CASI; A03, Hardcopy

Distributed computing applications for the 21st century are network centric, operating in a dynamic environment where clients, servers, and the network itself all have the potential to change drastically over time. A distributed application, a system of systems, must be constructed, consisting of legacy, commercial-off-the-shelf (COTS), database, and new client/server applications that must interact to communicate and exchange information between users, and allow users to accomplish their tasks in a productive manner. The issue is to promote the use of existing applications in new and innovative ways in a distributed environment that adds value. to adequately support this process, the network and its software infrastructure must be an active participant in the interoperation of distributed applications. Ideally, we are interested in new "components" as needs, requirements, and even network topologies change over time. JINI is a new architecture built on top of Java's remote method invocation (RMI) that promotes the construction and deployment of robust and scalable distributed applications in a network centric setting. JINI technology is forcing software designers and engineers to abandon the client/server view in order to adopt a client/services view. In JINI, a distributed application is conceptualized as a set of services (of all resources) being made available for discovery and use by clients. to accomplish this, JINI makes use of a lookup service, which is essentially a registry for tracking the services that are available within a distributed environment. Services in JINI discover and then join the lookup service, registering the services (of each resource) that are to be made available on the network. Thus, JINI is conceptually very similar to a distributed operating system, in the sense that resources of JINI are very similar to OS resources. However, in JINI these resources can be dynamically defined and changed.

Derived from text

Architecture (Computers); Distributed Processing; Applications Programs (Computers)

20000069242 Maryland Univ., Experimental Software Engineering Group, College Park, MD USA

A Classification of Software Components Incompatibilities for COTS Integration

Yakimovich, Daniil, Maryland Univ., USA; Travassos, Guilherme H., Universidade Federal do Rio de Janeiro, Brazil; Basili, Victor R., Maryland Univ., USA; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 25p; In English; See also 20000069222; No Copyright; Avail: CASI; A03, Hardcopy

Integration of software components into a system can be hindered by incompatibilities between the components and system. to predict the possible incompatibilities and the ways to overcome them during the integration activities, a classification of incompatibilities can be useful for software developers. This can be especially crucial for Commercial-off-the-shelf (COTS)-based software development, where a software system is being built out of potentially highly heterogeneous software components. The resulting system can have a complicated architecture due to the diversified nature of its components (e.g., a message-based system with object-oriented and procedural sub-systems), and the architectural incompatibilities of the COTS products must be overcome. Moreover, the functionality of the COTS software products must be taken into account during COTS integration. In this paper we present a classification of incompatibilities based on the properties of local component interactions. We believe that this

classification can capture possible problems about software component integration in heterogeneous software systems, including architectural and functional issues.
Author
Computer Programs; Software Engineering; Systems Integration; Computer Components; Systems Compatibility

20000069243 DaimlerChrysler Aerospace A.G., Dept. of Software Engineering, Ulm, Germany
Software Experience Center: The Evolution of the Experience Factory Concept
Houdek, Frank, DaimlerChrysler Aerospace A.G., Germany; Schneider, Kurt, DaimlerChrysler Aerospace A.G., Germany; Proceedings of the Twenty-Fourth Annual Software Engineering Workshop; March 2000; 11p; In English; See also 20000069222; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The experience factory concept, which was evolved at the NASA Software Engineering Laboratory, is a promising concept geared at facing the current needs in software development and software process improvement. Therefore, we at DaimlerChrysler decided to implement it in several business units to maintain and improve software engineering competence. In our efforts to establish the experience factory concept, we identified some shortcomings resulting from (unstated) assumptions. In this paper, we point out these assumptions and present how we evolved the experience factory concept. In particular, we introduced reinfusion concepts, concepts for experience evolution and for cost/benefit-ratio of experience items. An example taken from our business units helps to concretize our findings.
Author
Software Engineering; Software Development Tools; Computer Programs

20000069837 National Inst. of Standards and Technology, Gaithersburg, MD USA
Testability of Product Data Management Interfaces
Flater, D.; Morris, K. C.; Dec. 16, 1999; 28p
Report No.(s): PB2000-100843; NISTIR-6429; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Testability of Interaction-Driven Manufacturing Systems project seeks to enhance the design-for-testability of specifications for manufacturing software interfaces, derive a test method that is usable for interaction-driven manufacturing systems in general, and foster the reuse of testing artifacts. For our first testability study, we constructed some prototype conformance and interoperability tests for the Product Data Management Enablers standard from the Object Management Group. We reused test data developed for the Product Data Management Schema, a developing standard based on ISO 10303 (informally known as the Standard for Exchange of Product model data), and enumerated the lessons learned for testing and testability. We plan to reuse some of our new testing artifacts for testing an ISO 10303 Standard Data Access Interface to data based on the Product Data Management Schema.
NTIS
Interfaces; Manufacturing; Prototypes; Data Management

20000069843 Colorado Univ., Dept. of Electrical and Computer Engineering, Boulder, CO USA
Distributed Multisensor Fusion Algorithms for Tracking Applications *Final Report, Jun 1997-May 2000*
Pao, Lucy Y.; May 2000; 280p; In English
Contract(s)/Grant(s): N00014-97-1-0642
Report No.(s): AD-A377900; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The objective of the research under this ONR award is to develop multisensor fusion algorithms and sensor management techniques for tracking applications. Under this award, we have achieved a number of results: (1) We have developed a method of distributed fusion that is amenable to general distributed architectures; (2) We have developed non-simulation techniques for comparing multisensor fusion algorithms that are significantly more computationally efficient than performing Monte Carlo simulation evaluations; (3) We have investigated and compared the computational complexity and tracking performance of sequential and parallel implementations of multisensor fusion algorithms; (4) We have investigated the order of processing sensors of unequal qualities in sequential implementations of multisensor fusion algorithms; (5) We have developed several schemes for controlling sensor information and have evaluated the effects of sensor request delays; and (6) We have investigated the application of ordinal optimization and super-heuristic techniques for developing efficient implementations of our new sensor management methods. Our results have provided insight as to the relative performance of various multisensor fusion methods, and the results have also provided a basis for assessing the tradeoffs between performance and computational and communication requirements when planning new sensor network architectures or communication link protocols.
DTIC
Communication Networks; Algorithms; Management Methods

20000069857 Naval Postgraduate School, Monterey, CA USA

Re-Targeting the Graze Performance Debugging Tool for Java Threads and Analyzing the Re-Targeting to Automatically Parallelized (FORTRAN) Code

Tsai, Pedro T.; Mar. 2000; 157p; In English

Report No.(s): AD-A377839; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This research focuses on the design of a language-independent concept, Glimpse, for performance debugging of multi-threaded programs. This research extends previous work on Graze, a tool designed and implemented for performance debugging of C++ programs. Not only is Glimpse easily portable among different programming languages: (1) it is useful in many different paradigms ranging from few long-lived threads to many short-lived threads; and (2) it generalizes the concept of intervals over Graze's original definition. Glimpse's portability has been validated by demonstrating its usefulness in performance debugging of both Java programs as well as automatically parallelized FORTRAN programs.

DTIC

Software Engineering; C++ (Programming Language); Applications Programs (Computers); Checkout

20000070321 Notre Dame Univ., Dept. of Electrical Engineering, IN USA

Parallel and Distributed Algorithms for High-Speed Image Processing *Final Report*

Stevenson, Robert L., Notre Dame Univ., USA; Lumsdaine, Andrew, Notre Dame Univ., USA; Squires, Jeffery M., Notre Dame Univ., USA; McNally, Micheal P., Notre Dame Univ., USA; Apr. 2000; 151p; In English

Contract(s)/Grant(s): F30602-96-C-0235; AF Proj. 4594

Report No.(s): AD-A377689; AFRL-IF-RS-TR-2000-48; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

Typical desktop workstations can be a severe bottleneck in the viewing and enhancement of imagery data. Due to the nature of many image processing algorithms, an effective method for alleviating this problem is through parallelism. Parallel hardware can come in many forms, from small clusters of workstations and workstations with many processors to dedicated hardware containing 10's, 100's and 1000's of processing nodes. One of the challenges is developing a portable parallel image processing library in such a potentially diverse environment. These issues led to the development of a Parallel Image Processing Toolkit (PIPT). The toolkit hides the detail of parallelization from the users of the PIPT and provides a uniform programming interface. In developing the toolkit the issues of advanced data handling, load, balancing and parallel visualization were addressed. In addition a specific computationally expensive High Resolution Video Stills algorithm was implemented within the PIPT. The important contributions that resulted from this work transcend the individual tasks that were undertaken. First, the general approach that was taken to implement the PIPT illustrates several important principles for the design and implementation of general purpose parallel libraries. in this regard, the PIPT design can serve as a "design pattern" for an extensible parallel library. Second, the design pattern of the current implementation of the PIPT contains some notable attempts at programming image processing tasks in a generic fashion.

DTIC

Algorithms; Image Processing; Parallel Processing (Computers); Distributed Processing

20000070336 Nevada Univ., Reno, NV USA

Large Scale Biologically Realistic Models of Cortical Microcircuit Dynamics with Application to Novel Statistical Classifiers (Pilot Investigation) *Final Report, Jun.-Dec. 1999*

Goodman, Philip H.; Louis, Sushil J.; Markram, Henry; Jan. 31, 2000; 5p; In English

Contract(s)/Grant(s): N00014-99-1-0880

Report No.(s): AD-A377894; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of this project was to better understand brain-like network dynamics by incorporated biological parameters into large-scale computer simulations using parallel distributed "Beowulf" clustering. Milestones included improved single- processor efficiency of 24-fold. On multiprocessor clusters, initial time trials on - networks of 2 to 1000 cells suggests that the total time does not depend as heavily on the product (connection probability) x (N cells)squared, but shows a substantial * linear term. The projected time to run a 1-million cell simulation would be about 5.6 days on a single CPU, or roughly 6 hours on the proposed 30-CPU Beowulf system. Substantial progress was made toward a C++ implementation for subsequent research.

DTIC

Computerized Simulation; C++ (Programming Language); Multiprocessing (Computers); Microelectronics; Probability Theory

20000070436 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Program Transformation-What We Didn't Know

Feather, Martin S., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 2p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper presents the aspects of language programming transformations that were unknown in the early 1980's.
CASI

High Level Languages; Machine Translation; Language Programming

20000070452 NASA Ames Research Center, Moffett Field, CA USA

Co-evolution for Problem Simplification

Haith, Gary L., RECOM Technologies, Inc., USA; Lohn, Jason D., Caelum Research Corp., USA; Cplombano, Silvano P., NASA Ames Research Center, USA; Stassinopoulos, Dimitris, National Academy of Sciences - National Research Council, USA; [1999]; 16p; In English; 1999 Genetic and Evolutionary Computer Conference, 1999, USA

Contract(s)/Grant(s): NAS2-14217; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper explores a co-evolutionary approach applicable to difficult problems with limited failure/success performance feedback. Like familiar "predator-prey" frameworks this algorithm evolves two populations of individuals - the solutions (predators) and the problems (prey). The approach extends previous work by rewarding only the problems that match their difficulty to the level of solut,ion competence. In complex problem domains with limited feedback, this "tractability constraint" helps provide an adaptive fitness gradient that, effectively differentiates the candidate solutions. The algorithm generates selective pressure toward the evolution of increasingly competent solutions by rewarding solution generality and uniqueness and problem tractability and difficulty. Relative (inverse-fitness) and absolute (static objective function) approaches to evaluating problem difficulty are explored and discussed. On a simple control task, this co-evolutionary algorithm was found to have significant advantages over a genetic algorithm with either a static fitness function or a fitness function that changes on a hand-tuned schedule.
Author

Evolution; Genetic Algorithms; Simplification; Problem Solving

20000070463 NASA Langley Research Center, Hampton, VA USA

Fault Tree Analysis: A Bibliography

July 2000; 107p; In English

Contract(s)/Grant(s): RTOP 284-30-10-03

Report No.(s): NASA/SP-2000-6111; NAS 1.21:6111; L-17990; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Fault tree analysis is a top-down approach to the identification of process hazards. It is as one of the best methods for systematically identifying an graphically displaying the many ways some things can go wrong. This bibliography references 266 documents in the NASA STI Database that contain the major concepts. fault tree analysis, risk an probability theory, in the basic index or major subject terms. An abstract is included with most citations, followed by the applicable subject terms.
Author

Fault Trees; Probability Theory; Hazards

20000070486 Technische Hogeschool Twente, Faculty of Applied Mathematics, Enschede, Netherlands

Optimality Conditions for Generalized Semi-Infinite Programming Problems

Stein, O.; Still, G.; November 1997; ISSN 0169-2690; 22p; In English

Report No.(s): PB2000-104894; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Generalized semi-infinite optimization problems (GSIP) are considered. The authors generalize the well-known optimality conditions for minima of order one in standard semi-infinite programming to the case of GSIP. The authors give necessary and sufficient conditions for local minima of order one without the assumption of a 'local reduction'. The necessary conditions are derived along the same lines as the first order necessary conditions in a recent paper of Jongen, Ruckmann and Stein by assuming the so-called Extended Mangasarian-Fromovitz Constraint Qualification. Using the ideas in a recent paper of Ruckmann and Shapiro the authors can give short proofs of necessary and sufficient optimality conditions for minimizers of order one under the additional assumption of Mangasarian-Fromovitz Constrain Qualification at all local minima of the so-called lower level problem.
NTIS

Mathematical Programming; Optimization

20000070496 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA

Rapid Development of Custom Software Architecture Design Environments

Monroe, Robert T.; Aug. 1999; 206p; In English

Report No.(s): AD-A376894; CMU-CS-99-161; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

  Software architecture provides a powerful way to manage the complexity of large software systems. It has emerged as a distinct form of abstraction for software systems with its own set of design issues, vocabulary; and goals. Like designers in other disciplines, software architects can gain significant leverage by using powerful and appropriate design environments and tools. The cost and difficulty of creating these powerful design tools, however, prohibit their use for many software development projects. One of the primary reasons for the difficulty and cost of building these tools is that tool developers generally need to build a significant amount of supporting infrastructure before they can make use of the important architectural design expertise that the tools encapsulate. This infrastructure includes both the concepts underlying the tools' functionality and the implementation of the tools themselves. This dissertation describes a new approach to capturing and using architectural design expertise in software architecture design environments. A language and tools are presented for capturing and encapsulating software architecture design expertise within a conceptual framework of architectural styles and design rules. The design expertise thus captured is supported with an incrementally configurable software architecture design environment that specialized design environment builders and end-users can easily and quickly customize by specifying the architectural styles and design rules that the environment needs to support.

DTIC

Architecture (Computers); Computer Programming; Software Engineering

20000070497 Stanford Univ., Dept. of Aeronautics and Astronautics, Stanford, CA USA

Topic Number 6: Infrastructure to Enable High Performance Computing *Final Report, 15 Mar. 1997-14 Mar. 1998*

Springer, George S.; Jameson, Antony; Feb. 28, 1998; 5p; In English

Report No.(s): AD-A376889; AFRL-SR-BL-TR-00-0137; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

  The following document describes the use of the funds provided by the Air Force Office of Scientific Research to create a high performance laboratory for parallel fluid dynamics calculations. In the months following the submission of the proposal a sizable cost-sharing commitment was made by the Department of Aeronautics and Astronautics and the School of Engineering at Stanford University which allowed for a substantial increase in the scope of the equipment to be purchased. A large part of the equipment is already in place, and the final pieces will be arriving during the following weeks. The equipment acquired with the combination of the funds presented above includes the following: (1) Origin2009 Compute Server; and (2) Silicon Graphics Octane Graphics Workstations. The intent of this proposal was to facilitate the development of parallel computing methods for computational fluid dynamics calculations. Initially we had foreseen the acquisition of high performance workstations to pre- and post-process the data obtained from simulations performed on DoD supercomputers. With the new equipment it is now possible to, in addition, perform the initial development and debugging of the programs in-house. This mode of operation enables us to use DoD facilities in a truly productive fashion, and it avoids the long time delays during the early development stages due to network connections and the usual batch environment of today's supercomputers.

DTIC

Supercomputers; Parallel Processing (Computers); Program Verification (Computers)

20000070505 New Energy and Industrial Technology Development Organization, Tokyo, Japan

Fiscal 1997 project on the R and D of industrial scientific technology under consignment from NEDO. Report on the results of the R and D of new software structuring models (R and D of micromachine cooperative control use software)

Mar. 31, 1998; 332p; In Japanese; In English

Report No.(s): DE99-718343; ETDE/JP-99718343; No Copyright; Avail: Department of Energy Information Bridge

  A R and D was conducted of software structuring models which ease the development and maintenance of software systems and meet diversification of needs. As for the study of the cooperative control use programming language, a R and D of agent oriented language Flage was carried out for expansion of language function, arrangement of network function, development of exercises, etc. As to the formulation of agent knowledge, proposed were processes to make a program from the specifications, and EVA, a mechanism in response to changes in the specifications of existing programs. In relation to the basic theory of cooperation system, a study was made mainly of object oriented attribute grammar OOAG as a model representing cooperative computation in software process as a rule group. Concerning the study of the situation recognition mechanism, models were researched of communication and reasoning among agents in cooperation.

NTIS

Software Engineering; Microelectromechanical Systems

Naval Postgraduate School, Monterey, CA USA

Decision Support for Software Process Management Teams: An Intelligent Software Agent Approach

Church, Lori A.; Mar. 2000; 132p; In English

Report No.(s): AD-A377649; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

   Currently, SPAWAR Systems Center is lacking a unified software development environment that allows software developers to effectively manage software development projects across a diversified development environment. This unified environment is needed to provide up-to-date accurate information to the right people at the right time, increase the process knowledge-base, increase productivity, decrease time to market, eliminate redundancy, and ease job stress. This thesis proposes a conceptual model for software process management decision support in the form of an intelligent software agent network. The intelligent software agent network, called MENTOR, provides the knowledge-base that is crucial to the software development team, providing for a repeatable, defined, managed, and optimized development environment. This concept provides SSC software development managers and team members with the ability to work in a unified and collaborative environment, regardless of organizational diversity or location. MENTOR will be utilized as an integral software development team member, providing tutorials and mentoring capabilities for management and process assistance, as well as providing process planning, risk analysis, and strategic planning recommendations for the successful completion of a software development effort, at all team levels. In addition, MENTOR will provide an effective communication environment that will enable the development team to minimize the time consuming workload involved in tracking individual tasking.

DTIC

Computer Programming; Computer Programs; Software Engineering; Management Methods; Artificial Intelligence; Decision Support Systems

Malaysia Univ., Inst. of Design and Ergonomics Application, Sarawak, Malaysia

International Training Workshop on "Using Anthropometry for Effective Solutions", *27-30 Mar. 00*

May 18, 2000; 338p; In English, 27-30 Mar. 2000, Kuching, Sarawak, Malaysia

Contract(s)/Grant(s): F6256200M9022

Report No.(s): AD-A377777; CSP-001004; No Copyright; Avail: CASI; A03, Microfiche; A15, Hardcopy

   Proceedings Include the Following Topics: (1) "Introduction to Ergonomics, Anthropometry. and User Centered Design"; (2) "Principles and Practice of Anthropometry"; (3) "Human Diversity"; (4) "Axiomatic Design"; (5) "Application 1: Chair and Microscope Workstation Design" "Development of A National Anthropometric Database"; (6) "Application 2: Footwear and Clothes Design" "Effective Anthropometry Process"; (7) "Statistics for Anthropometry"; (8) "Anthropometric Fit Mapping"; (9) "Application 3: Crew Station Design"; (10) "3-D Solutions"; (11) "CAESAR - 3D Anthropometry Survey"; (12) "Cleopatra: A Database Management for CAESAR"; (13) "3D Body Scanners"; (14) "Polyworks"; (15) "Integrate"; (16) "Rapid Prototyping Techniques "Survey Process Optimization"; and (17) "Hands-on Anthropometric Methods".

DTIC

Anthropometry; Conferences; Human Factors Engineering

NASA Langley Research Center, Hampton, VA USA

Information-Theoretic Assessment of Sample Imaging Systems

Huck, Friedrich O., NASA Langley Research Center, USA; Alter–Gartenberg, Rachel, Computer Sciences Corp., USA; Park, Stephen K., College of William and Mary, USA; Rahman, Zia–ur, College of William and Mary, USA; Optical Engineering; May 1999; ISSN 0091-3286; Volume 38, No. 5, pp. 742-762; In English; Copyright; Avail: Issuing Activity

   By rigorously extending modern communication theory to the assessment of sampled imaging systems, we develop the formulations that are required to optimize the performance of these systems within the critical constraints of image gathering, data transmission, and image display. The goal of this optimization is to produce images with the best possible visual quality for the wide range of statistical properties of the radiance field of natural scenes that one normally encounters. Extensive computational results are presented to assess the performance of sampled imaging systems in terms of information rate, theoretical minimum data rate, and fidelity. Comparisons of this assessment with perceptual and measurable performance demonstrate that (1) the information rate that a sampled imaging system conveys from the captured radiance field to the observer is closely correlated with the fidelity, sharpness and clarity with which the observed images can be restored and (2) the associated theoretical minimum data rate is closely correlated with the lowest data rate with which the acquired signal can be encoded for efficient transmission.

Author

Imaging Techniques; Rates (Per Time); Statistical Distributions; Communication Theory; Data Transmission

20000072472 Department of Defense, Office of the Inspector General, Arlington, VA USA

Fiscal Year 1999 Automated Document Conversion System Program

Granetto, Paul J.; Stephenson, Garold E.; Kissner, Eugene E.; Griffin, Samuel R.; Lee, Peter I.; May 02, 2000; 26p; In English

Report No.(s): AD-A376955; IG/DOD-D-2000-119; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We performed the audit in response to a request from the Assistant Deputy Under Secretary of Defense (Logistics Architecture). The Automated Document Conversion System Program is a Congressionally-sponsored, DoD-wide program to purchase hardware, drawing system solutions, and document conversion software and services for DoD to attain its goal of achieving a paperless, integrated, digital environment by the year 2002. Congress appropriated $45 million for the FY 1999 Automated Document Conversion System Program. The overall audit objective was to evaluate the effectiveness of the project selection and contract award processes for the FY 1999 Automated Document Conversion System Program. Specific objectives were to determine whether the procedures for selecting projects for contract award were adequate and complied with, and whether the procedures for awarding Automated Document Conversion System Program contracts promoted full and open competition.

DTIC

Computer Programs; Conversion

20000072477 Alabama Univ., Huntsville, AL USA

Integrated Product Development Tools Integration and Development *Final Report, 22 Jun. 1995-30 Apr. 1996*

Maddux, Gary A.; Jul. 1999; 8p; In English

Contract(s)/Grant(s): DAAH01-98-D-0006

Report No.(s): AD-A377003; 5-34687; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Production Engineering Division (PED) of the System Engineering and Production Directorate (SEPD), Research, Development and Engineering Center (RDEC) was identified as the U.S. Army Missile Command's (MICOM) proponent for Integrated Product Development (IPD). As the Command's focal point it became apparent that 5 Command IPD system was needed to aid programs with the implementation and conduct of IPD. In an effort to develop such a system a Missile PD Demonstration was proposed and the results of this task fed directly into the demonstration and the eventual Command IPD system. This report documents work performed on this effort.

DTIC

Computer Aided Manufacturing; Computer Aided Design; Missiles; Product Development; Production Engineering

20000072479 Information Technology Resources Board, Unknown, USA

Assessing the Risks of Commercial-Off-The-Shelf Applications. Lessons Learned from the Information Technology Resources Board

December 1999; 28p; In English

Report No.(s): PB2000-106055; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Increasingly, Federal agencies are turning to a Commercial Off the Shelf (COTS) application package solution for requirements that previously were met by in-house or contractor software development projects. The Information Technology Resources Board (ITRB) believes that the availability of appropriate guidelines and information gleaned from case examples will promote a greater awareness and better informed decisions when considering a COTS solution. This in turn, will lead to more successful COTS implementations in the Federal environment and ideally, result in better service to the American public. So, the ITRB has developed this tool to assist Federal organizations in clarifying the myriad risks they will encounter when facing a COTS implementation. We also recognize the value of sharing practical, proven experiences. to supplement the Risk Profile, the ITRB offers the following 'lessons learned' distilled from our extensive experience in developing, acquiring, and managing information systems for the Federal government.

NTIS

Information Systems; Software Engineering; Risk; Applications Programs (Computers)

20000072577 New Mexico State Univ., Klipsch School of Electrical and Computer Engineering, Las Cruces, NM USA

Enhancement of the NMSU Channel Error Simulator to Provide User-Selectable Link Delays

Horan, Stephen, New Mexico State Univ., USA; Wang, Ru–Hai, New Mexico State Univ., USA; Apr. 30, 2000; 32p; In English

Contract(s)/Grant(s): NAG5-7520

Report No.(s): NMSU-ECE-00-001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is the third in a continuing series of reports describing the development of the Space-to-Ground Link Simulator (SGLS) to be used for testing data transfers under simulated space channel conditions. The SGLS is based upon Virtual Instrument (VI) software techniques for managing the error generation, link data rate configuration, and, now, selection of the link delay value.

In this report we detail the changes that needed to be made to the SGLS VI configuration to permit link delays to be added to the basic error generation and link data rate control capabilities. This was accomplished by modifying the rate-splitting VIs to include a buffer the hold the incoming data for the duration selected by the user to emulate the channel link delay. In sample tests of this configuration, the TCP/IP(sub ftp) service and the SCPS(sub fp) service were used to transmit 10-KB data files using both symmetric (both forward and return links set to 115200 bps) and unsymmetric (forward link set at 2400 bps and a return link set at 115200 bps) link configurations. Transmission times were recorded at bit error rates of 0 through 10(exp -5) to give an indication of the link performance. In these tests. we noted separate timings for the protocol setup time to initiate the file transfer and the variation in the actual file transfer time caused by channel errors. Both protocols showed similar performance to that seen earlier for the symmetric and unsymmetric channels. This time, the delays in establishing the file protocol also showed that these delays could double the transmission time and need to be accounted for in mission planning. Both protocols also showed a difficulty in transmitting large data files over large link delays. In these tests, there was no clear favorite between the TCP/IP(sub ftp) and the SCPS(sub fp). Based upon these tests, further testing is recommended to extend the results to different file transfer configurations. Author

Augmentation; Bit Error Rate; Protocol (Computers); Time Lag; Fabrication; Data Transfer (Computers); Computer Techniques; Computerized Simulation

20000073241 NASA Goddard Space Flight Center, Greenbelt, MD USA

Perl Tools for Automating Satellite Ground Systems

McLean, David, Honeywell, Inc., USA; Haar, Therese, Honeywell, Inc., USA; McDonald, James, Honeywell, Inc., USA; [2000]; 10p; In English

Contract(s)/Grant(s): NASA Order S-31803-G; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The freeware scripting language Pert offers many opportunities for automating satellite ground systems for new satellites as well as older, in situ systems. This paper describes a toolkit that has evolved from of the experiences gained by using Pert to automate the ground system for the Compton Gamma Ray Observatory (CGRO) and for automating some of the elements in the Earth Observing System Data and Operations System (EDOS) ground system at Goddard Space Flight Center (GSFC). CGRO is an older ground system that was forced to automate because of fund cuts. Three 8 hour shifts were cut back to one 8 hour shift, 7 days per week. EDOS supports a new mission called Terra, launched December 1999 that requires distribution and tracking of mission-critical reports throughout the world. Both of these ground systems use Pert scripts to process data and display it on the Internet as well as scripts to coordinate many of the other systems that make these ground systems work as a coherent whole. Another task called Automated Multimodal Trend Analysis System (AMTAS) is looking at technology for isolation and recovery of spacecraft problems. This effort has led to prototypes that seek to evaluate various tools and technology that meet at least some of the AMTAS goals. The tools, experiences, and lessons learned by implementing these systems are described here. Author

Prototypes; Internets; Earth Observing System (EOS); Data Processing; Computer Programs; Language Programming

20000073248 Naval Postgraduate School, Monterey, CA USA

Automated Generation of Wrappers For Interoperability

Ngom, Cheng H.; Mar. 2000; 165p; In English

Report No.(s): AD-A377738; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Interoperability between software systems is the ability to exchange services from one system to another. In order to exchange services, data and commands are relayed from the service providers to the requesters. Presently, there are some interoperability techniques that aid the exchange of information, ranging from low-level sockets and messaging techniques to more sophisticated middleware technology like object resource brokers. Middleware technology uses higher abstraction than messaging, and can simplify the construction of interoperable applications. It provides a bridge between the service provider and requester by providing standardized mechanisms that handle communication, data exchange and type marshalling. However, in current interoperability techniques, data and services are tightly coupled to a particular server. Furthermore, most developers are trained in developing stand-alone applications rather than distributed applications. This thesis aims at developing a generic interface wrapper that can be used to separate the data and services from the server, and allows the developers to treat distributed data and services as those they are local within an application process space. In addition, the research developed a program to fully automate the process of generating the interface wrapper directly from a specification language such as Prototype System Description Language (PSDL). DTIC

Software Engineering; C (Programming Language); Information Flow; Computer Programs

20000073281 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

Software Architecture Evaluation with ATAM in the DoD System Acquisition Context *Final Report*

Bergey, John K.; Fisher, Matthew J.; Jones, Lawrence G.; Kazman, Rick; Sep. 1999; 24p; In English

Report No.(s): AD-A377450; CMU/SEI-99-TN-012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    Many modern defense systems rely heavily on software to achieve system functionality. Because software architecture is a major determinant of software quality, it follows that software architecture is critical to the quality of a software-intensive system. For a Department of Defense (DoD) acquisition organization, the ability to evaluate software architectures can have a favorable impact on the delivered system. This technical note explains the basics of software architecture and software architecture evaluation in a system-acquisition context. It also sets the context for applying software architecture evaluation based on the Architecture Tradeoff Analysis Method(sm) (ATAM(sm)) in the DoD acquisition environment. Future versions of this technical note will expand upon this conceptual approach and provide additional details drawn from real experiences.

DTIC

Software Engineering; Program Verification (Computers); Computer Systems Programs

20000073282 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

The November 1999 High Maturity Workshop *Final Report*

Paulk, Mark C.; Chrissis, Mary B.; Mar. 2000; 117p; In English

Contract(s)/Grant(s): F19628-95-C-0003

Report No.(s): AD-A377440; CMU/SEI-2000-SR-003; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

    A workshop for high maturity organizations was held on November 16-18, 1999, at the Software Engineering Institute (SEI) in Pittsburgh. The purpose of this workshop was to better Understand practices that characterize Level 4 and 5 organizations. Topics of discussion included both practices described in the CMM (CAPABILITY MATURITY MODEL) and other practices that have a significant impact in mature organizations. Two themes were anticipated to be important to the workshop participants: statistical process control for software and the reliability and credibility of Level 4 and 5 assessments. Additional topics were solicited from the participants on CMM integration, measurement, technology, human issues, and quality assurance. This report contains brief summaries of the high maturity organizations participating in the workshop and the various working group reports.

DTIC

Software Engineering; Mathematical Models; Quality Control; Computer Programming

20000073284 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

Analysis of Lead Assessor Feedback for CBA IPI Assessments Conducted July 1998 - October 1999 *Final Report*

Dunaway, Donna K.; Seow, Mui L.; Baker, Michele; Apr. 2000; 48p; In English

Contract(s)/Grant(s): F19628-95-C-0003

Report No.(s): AD-A377438; CMU/SEI-2000-TR-005; ESC*-TR-2000-005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    In the Appraiser Program of the Software Engineering Institute (SEI), authorized Lead Assessors lead Capability Maturity Model-Based Appraisals for Internal Process Improvement (CBA IPI). At the conclusion of each assessment, they are required to submit certain artifacts to the SEI. Data from assessments is recorded to provide the community with information on the state of the software community's process maturity, as related to the Capability Maturity Model (CMM) for Software Version 1.1. These data can be viewed on the SEI Web site: <URLhttp://www.sei.cmu.edusema/profile.html>. Additional feedback data are required of a Lead Assessor in order to monitor the consistency of use of the assessment method for quality control purposes. Data are collected from Lead Assessors, assessment team members, and sponsors of the assessments. The results reported in this document reflect information sent to the SE by Lead Assessors through a Lead Assessor's Requirements Checklist. The checklist aids the Lead Assessors in keeping track of their implementation of each of the method's requirements. The checklist also provides information back to the community regarding metrics being reported by Lead Assessors; this helps in more effective planning for future assessments. In addition, the checklist acts as a quality control mechanism to monitor the consistency of use of each of the method's activities.

DTIC

Software Engineering; Program Verification (Computers); Computer Programming

20000073704 Army Research Lab., Sensors Directorate, Adelphi, MD USA

Natural Computing: Its Impact on Software Development *Final Report, 1995-1997*

Karamchetty, Som; Feb. 2000; 54p; In English

Report No.(s): AD-A374337; ARL-TR-2040; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Many software engineering problems stem, in part, from the need for software designers to understand specialized knowledge domains. Current computer software systems are not capable of representing familiar calculation features such as equations, tables, graphs, procedures, and pictures so that these features assist humans to perform calculations in a natural, intuitive way. This report explains the need for these features to present users with "natural" ways of doing calculations-that is, ways analogous to the paper-based techniques used in the absence of computers. Features presented in this way would make computing more transparent and intuitive. In the Natural Computing approach proposed in this report, software tools are first developed and then given to domain specialists to use in their calculation methods, knowledge, and data. As domain knowledge changes and grows, and/or new calculation methods are needed, software developers can add new methods and procedures to the existing methods (or delete old ones) and develop successively enhanced versions of application software for use by both specialists and naive end users. Domain information and knowledge can be captured in electronic books and communicated electronically for further expeditious use. Natural Computing eases application system development and accelerates domain knowledge dissemination, leading to quicker development of further knowledge.
DTIC
Applications Programs (Computers); Computer Programming; Software Engineering

20000073705 Army Research Lab., Sensors Directorate, Adelphi, MD USA
Natural Computing: Analysis of Tables for Computer Representation *Final Report, 1995-1997*
Karamchetty, Som; Feb. 2000; 62p; In English
Report No.(s): AD-A374338; ARL-TR-2041; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
   Some fundamental objects in practical documents have not been implemented in software so that they can be used easily for calculating. One such object is the table-despite the mistaken view that databases are adequate representations of tables. A survey of practical tables found in a variety of real-world documents reveals that many of their useful features are not captured in software. This report proposes data structures and computer representation for table objects. Through the adoption of such structures and representations, practical table objects can be developed for use by domain specialists. Such tables embedded in electronic documents can be used in interactive applications to retrieve data, but most importantly, they can be used as functional representations for copying and pasting into procedures and programs. Use of these table objects, together with other natural computing objects (such as equations, graphs, and procedures), will permit electronic documents like handbooks, textbooks, journals, and bulletins to be used seamlessly for calculations by both domain specialists and naive users. Such developments will reduce the lag between the availability of information and its use in calculations, and encourage the further development of knowledge. Software development for computation will change and its costs will be contained.
DTIC
Computer Programming; Computerized Simulation; Software Engineering; Computer Programs; Computation

20000073735 Joint Advanced Distributed Simulation Joint Test Force, Albuquerque, NM USA
JADS Special Report on Verification, Validation and Accreditation of Distributed Tests
Roane, Michael; Marchand, Gary; Oct. 1999; 33p; In English
Report No.(s): AD-A377909; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
   The joint Advanced Distributed Simulation (JADS) Test and Evaluation program was chartered by the Deputy Director , Test, Systems Engineering and Evaluation (Test and Evaluation), Office of the Secretary of Defense (Acquisition and Technology) in October 1994 to investigate the utility of advanced distributed simulation (ADS) technologies for support of test and evaluation (T and E). The JADS Joint Test Force (JTF) is Air Force led, with Army and Navy participation, and is scheduled for completion in March 2000. JADS JTF conducted three tests currently fielded system using a ADS enhanced test environment. The System Integration Test (SIT) explored ADS of air-to-air missile testing. The End-to-End (ETE) Test investigated ADS support for command, control, communication, computers, intelligence, surveillance and reconnansiance (C4ISR) testing and the Electronic Warfare (EW) Test examined ADS support for EW testing. The JADS JTF was also chartered to observe or to participate at a modest level in ADS activities sponsored and conducted by other agencies in an effort to broaden conclusions developed in the three dedicated test areas. Verification, validation and accreditation (VV&A) are key methodologies required for the use for ADS in support of developmental test and evaluation (DT&E) and operational test and evaluation (OT&E). In keeping with the JADS charter to explore the critical constraints, concerns, and methodologies when using ADS for T&E, this report addresses the present state of the VV&A of ADS-enhanced test environments. It first assesses the status of the VV&A of ADS-enhanced test environment as represented by directives, regulations and formal processes. Next it presents the VV&A processes used by each of the

three JADS tests, lessons learned, and finally, the report draws conclusions and provides a recommended guide to the VV&A of an ADS-enhanced test environment.
Author
Performance Tests; Evaluation; Proving; Surveillance; Simulation; Command and Control

20000074061 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Abstract for 1999 Rational Software User Conference
Dunphy, Julia, Jet Propulsion Lab., California Inst. of Tech., USA; Rouquette, Nicolas, Jet Propulsion Lab., California Inst. of Tech., USA; Feather, Martin, Jet Propulsion Lab., California Inst. of Tech., USA; Tung, Yu–Wen, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; 1999 Rational Software User Conference, 25-29 Jul. 1999, Seattle, WA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We develop spacecraft fault-protection software at NASA/JPL. Challenges exemplified by our task: 1) high-quality systems - need for extensive validation & verification; 2) multi-disciplinary context - involves experts from diverse areas; 3) embedded systems - must adapt to external practices, notations, etc.; and 4) development pressures - NASA's mandate of "better, faster, cheaper".
Author
Conferences; Computer Programs

20000074078 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Flight Validation of On-Demand Operations: The Deep Space One Beacon Monitor Operations Experiment
Wyatt, Jay, Jet Propulsion Lab., California Inst. of Tech., USA; Sherwood, Rob, Jet Propulsion Lab., California Inst. of Tech., USA; Sue, Miles, Jet Propulsion Lab., California Inst. of Tech., USA; Szijjarto, John, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

After a brief overview of the operational concept, this paper will provide a detailed description of the _as-flown_ flight software components, the DS1 experiment plan, and experiment results to date. Special emphasis will be given to experiment results and lessons learned since the basic system design has been previously reported. Mission scenarios where beacon operations is highly applicable will be described. Detailed cost savings estimates for a sample science mission will be provided as will cumulative savings that are possible over the next fifteen years of NASA missions.
Author
Flight Control; Deep Space; Beacons

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see 82 Documentation and Information Science. For computer systems applied to specific applications, see the associated category.

20000068526 Naval Postgraduate School, Monterey, CA USA
Design and Implementation of a Three-Tiered Web-Based Inventory Ordering and Tracking System Prototype Using CORBA and Java
Otoom, Ahmed; Mar. 2000; 228p; In English
Report No.(s): AD-A376831; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Many enterprises are still running and maintaining several operating system and platform dependent legacy applications. The variety of platforms and operating systems poses a challenge to system-wide interoperability and performance, increases the cost of maintenance, locks enterprises into certain vendors, and leads to a lack of an adequate information infrastructure which results in a waste of computer resources, manpower, and time. In this thesis, we have designed and implemented a component-based three-tiered Web-based Inventory Ordering and Tracking System (IOTS) prototype that demonstrates the technical feasibility of making an enterprise's applications both interoperable and salable on a system composed of multiple platforms and different operating systems. The prototype uses CORBA, an industry-backed, non-proprietary, standard-based distributed architecture and Java, a high-level object-oriented language that enables enterprises to leverage the use of the Internet and benefit from the enhancements in the client/server and the decrease in the prices of desktop computers. The prototype demonstrates how to overcome the problem of the stateless nature of HTTP and build the Object Web where Java applets run on the IIOP. The prototype's

source code can be tailored to some specific business requirements and enterprises having problems similar to those addressed may benefit from this research and adopt, its development methodology.
DTIC
Relational Data Bases; Electronic Commerce; Object-Oriented Programming; Applications Programs (Computers); Inventories

20000068915 MRJ Technology Solutions, Moffett Field, CA USA
Performance Modeling and Measurement of Parallelized Code for Distributed Shared Memory Multiprocessors
Waheed, Abdul, MRJ Technology Solutions, USA; Yan, Jerry, MRJ Technology Solutions, USA; [1 Dec. 1998]; 24p; In English
Contract(s)/Grant(s): NAS2-14303; RTOP 510-40-12
Report No.(s): NAS-98-012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
     This paper presents a model to evaluate the performance and overhead of parallelizing sequential code using compiler directives for multiprocessing on distributed shared memory (DSM) systems. With increasing popularity of shared address space architectures, it is essential to understand their performance impact on programs that benefit from shared memory multiprocessing. We present a simple model to characterize the performance of programs that are parallelized using compiler directives for shared memory multiprocessing. We parallelized the sequential implementation of NAS benchmarks using native FORTRAN77 compiler directives for an Origin2000, which is a DSM system based on a cache-coherent Non Uniform Memory Access (ccNUMA) architecture. We report measurement based performance of these parallelized benchmarks from four perspectives: efficacy of parallelization process; scalability; parallelization overhead; and comparison with hand-parallelized and -optimized version of the same benchmarks. Our results indicate that sequential programs can conveniently be parallelized for DSM systems using compiler directives but realizing performance gains as predicted by the performance model depends primarily on minimizing architecture-specific data locality overhead.
Author
Models; Distributed Memory; Performance Prediction; Multiprocessing (Computers); Evaluation

20000069000 MRJ Technology Solutions, Moffett Field, CA USA
A New Approach to Parallel Dynamic Partitioning for Adaptive Unstructured Meshes
Heber, Gerd, Delaware Univ., USA; Biswas, Rupak, MRJ Technology Solutions, USA; Gao, Guang R., Delaware Univ., USA; [1999]; 6p; In English; IPPS'99, 12-16 Apr. 1999, San Juan, Puerto Rico
Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
     Classical mesh partitioning algorithms were designed for rather static situations, and their straightforward application in a dynamical framework may lead to unsatisfactory results, e.g., excessive data migration among processors. Furthermore, special attention should be paid to their amenability to parallelization. In this paper, a novel parallel method for the dynamic partitioning of adaptive unstructured meshes is described. It is based on a linear representation of the mesh using self-avoiding walks.
Author
Computational Grids; Algorithms

20000069033 Naval Postgraduate School, Monterey, CA USA
Network Policy Management
Wetzel, Paul A.; Sep. 1999; 246p; In English
Report No.(s): AD-A376856; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche
     Effective military and commercial use of Internet to conduct mission critical and commerce oriented transactions over shared networks is increasingly inhibited by the shortcomings of the very enabling technology of the Internet - the TCP/IP protocol. Without network performance, security and other management controls, TCP/IP networks can't meet the overall requirements of a network. To complicate the network policy management issues, new applications are exchanging increasingly larger amounts of digital data (image, audio, video, etc.), and some of them require stringent Quality-Of-Service (QOS) measured by delay and loss from the network. This places very diverse but demanding requirements on the network in terms of bandwidth and data delivery dependencies on the network. In many cases this network traffic diversity has led to major network performance and reliability problems as well as a resultant loss of productivity among network users. Typical 10Mbit Ethernet LANs or even 100Mbit switched LANs running TCP/IP are no longer adequate to handle the various types of next generation applications being written and the existing mission critical applications. The bottom line is that more than bandwidth is required and the existing network infrastructure installed base make it impossible to quickly change to a new standard such as ATM for all desktop connections. As a result there is a growing need for management tools capable of running a new generation of applications over existing

infrastructure. These requirements have not gone unnoticed by Government and commercial enterprises, network infrastructure vendors or the standards bodies.

DTIC

Computer Information Security; Local Area Networks; Internets; Protocol (Computers)

20000069645 Army War Coll., Carlisle Barracks, PA USA

Information Superiority as an American Center of Gravity: Concepts for Change in the 21st Century

Horne, Jeffrey C.; Apr. 10, 2000; 34p; In English

Report No.(s): AD-A377575; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

America has made a choice; more than any other nation, the USA is dependent on cyberspace. We have embraced new information technologies, and the trappings of the revolution they have ignited, with unbridled enthusiasm. Our homes, schools, businesses, markets, communication systems, and transportation grids rely on information and telecommunication systems beyond expectations of only a decade ago. Accordingly, the information distribution and processing infrastructures supporting the U.S. elements of national power have become strategic assets worthy of a detailed protection plan to ensure their viability against any intruder. The U.S. Military's vision for the conduct of future wars, Joint Vision 2010, embraces these views and calls for information superiority as a baseline requirement in achieving battlefield dominance in future wars. This paper focuses on the effects of the information revolution and geostrategic change as they relate to evolving national security paradigms and developing military doctrine. We review the informational threat, examine specific incursions, and develop emotive concepts for the defense of military information networks while also presenting rationale for sharing offensive information operation capabilities with our foes. The discussion concludes with strategic recommendations to continue refinement of our efforts to achieve information superiority well into the millennium.

DTIC

Telecommunication; Information Systems; Internet Resources; Military Technology; Information Resources Management; Computer Information Security; Defense Program

20000069863 Army War Coll., Carlisle Barracks, PA USA

Peacetime Use of Computer Network Attack

Busby, Daniel J.; Apr. 03, 2000; 29p; In English

Report No.(s): AD-A377624; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Published in May 1998, Presidential Decision Directive 63 (PDD-63), The Critical Infrastructure Protection Directive, calls for a national effort to protect America's increasingly vulnerable and interconnected information infrastructures. Such infrastructure includes telecommunications, banking and finance, energy, transportation, and essential government services. PDD-63 alerts the nation to prepare for impending cyber attacks. This paper examines the nature, scale, and likelihood of cyber attacks posited in PDD-63 and finds that the country does not face an imminent "electronic Pearl Harbor". Nonetheless, the country's information infrastructure is vulnerable to cyber attacks by a plethora of adversaries. The most dangerous threat is from state-sponsored cyber-warriors. In view of this real and growing threat, the prescriptions in PDD-63 for protecting the infrastructure are inadequate. This paper concludes that the defensively oriented policy measures in PDD-63 are insufficient for protecting the infrastructure. These measures are not working now, and because they are entirely reactive by nature, they will not deter future attacks by state-sponsored cyber-warriors. With the potential for severe disruptions to the infrastructure so great, this paper argues that the United States must conduct open, offensive Computer Network Attacks against state-sponsored cyber-warriors during peacetime. Only then will the country be able to stop these adversaries and adequately protect its infrastructure.

DTIC

Computer Networks; Telecommunication; Network Control; Computer Information Security

20000070423 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA

Experiences Designing and Building a Multi-Hop Wireless Ad Hoc Network Testbed

Maltz, David A.; Broch, Josh; Johnson, David B.; Mar. 05, 1999; 22p; In English

Contract(s)/Grant(s): F19628-96-C-0061

Report No.(s): AD-A368412; CMU-CS-99-116; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

In this paper, we describe our experiences building a multi-hop wireless ad hoc network of 8 nodes driving around a 700 m by 300 m site. Each node runs the Dynamic Source Routing (DSR) protocol and interfaces seamlessly with existing Internet infrastructure and the Mobile IP protocol. The issues discussed in this paper range from logistical and management issues, to protocol design and performance analysis issues. We also present an early characterization of the testbed performance, and describe a

significant new challenge for ad hoc network routing protocols. The major goal of the paper, however, is to share our experiences, in the belief that they may be useful to others who attempt to build other ad hoc network testbeds.
DTIC
Computer Networks; Wireless Communication; Radiotelephones; Design Analysis

20000070456 Computer Sciences Corp., Hanover, MD USA

Evaluation of an Internet-Based, Bibliographic Database: Results of the NASA STI Program's ASAP User Test

Reid, John, Computer Sciences Corp., USA; Egge, Robert, Computer Sciences Corp., USA; McAfee, Nancy, Computer Sciences Corp., USA; June 2000; 13p; In English

Contract(s)/Grant(s): NAS1-20048; RTOP 284-30-10-03

Report No.(s): NASA/CR-2000-210018; NAS 1.26:210018; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document summarizes the feedback gathered during the user-testing phase in the development of an electronic library application: the Aeronautics and Space Access Pages (ASAP). It first provides some historical background on the NASA Scientific and Technical Information (STI) program and its efforts to enhance the services it offers the aerospace community. Following a brief overview of the ASAP project, it reviews the results of an online user survey, and from the lessons learned therein, outlines direction for future development of the project.

Author

Systems Engineering; Data Management; Bibliographies; Data Bases

20000070765 National Science and Technology Council, Committee on Computing, Information, and Communications, Washington, DC USA

Research Challenges in High Confidence Systems: Proceedings of the Committee on Computing, Information and Communications Workshop

1997; 52p; In English, 6-7 Aug. 1997, Alexandria, VA, USA; Original contains color illustrations

Report No.(s): PB2000-106058; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The objectives of the workshop were to explore research topics that would enable the creation of new technologies for developing and assessing high confidence systems, to recommend integrated research challenges to stimulate and focus high confidence systems research, and to suggest national goals and benefits to encourage U.S. Government interagency commitment to a national research agenda in high confidence systems. to achieve its objectives, the workshop considered the findings of the 1995 Committee on Information and Communications (CIC), and explored in more detail the gap between the needs for high confidence and the HCS state-of-the-art for high confidence, as well as the research needed to begin to fill in that gap.

NTIS

Computer Networks; Research; Technology Utilization; Conferences; Information Management; Communication

20000072497 Maryland Univ., College Park, MD USA

Thread Migration and Communication Minimization in DSM Systems

Thitikamol, Kritchalach; Keleher, Pete; Apr. 1998; 10p; In English

Report No.(s): AD-A377024; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Networks of workstations are characterized by dynamic resource capacities. Such environments can only be efficiently exploited by applications that are dynamically re-configurable. This paper explores mechanisms and policies that enable online reconfiguration of shared-memory applications through thread migration. We describe the design and preliminary performance of a DSM system that performs online re-mappings of threads to nodes based on sharing behavior. Our system obtains complete sharing information through a novel correlation-tracking phase that avoids the thread thrashing that characterizes previous approaches. This information is used to evaluate the communication required by a given thread mapping, and to predict the resulting performance.

DTIC

Distributed Processing; Data Management; Parallel Processing (Computers); Computer Networks

20000073249 Naval Postgraduate School, Monterey, CA USA

Object Signing in Bamboo

Smith, Marion L.; Mar. 2000; 134p; In English

Report No.(s): AD-A377760; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The rapid growth in the Internet has been fueled by an exorbitant number of users, organizations and individuals alike, many relying on e-commerce to conduct business including the transport of files. Public Key Infrastructure (PKI) technology has

emerged to the forefront as the basis for ensuring secure transactions throughout the Internet. However, this technology is prohibitively expensive for the majority of users. Object signing technology, a subset of PKI technology, provides a veritable means for file transfer ensuring non-repudiation, authentication, and content integrity at an amenable cost. This thesis provides an introduction to computer security with a specific focus on PKI and object signing technology. It details the selection and implementation of an object signing system layered on Bamboo, namely Pretty Good Privacy (PGP) v2.6.2. Procedures for establishing a Key Server for certificate distribution are also illustrated. It also introduces security pitfalls associated with PKI systems and identifies the security weaknesses of this object signing implementation. For further research, recommendations are provided to improve the overall functionality of this security system and the potential impact any such migration may have on current users.
DTIC
Computer Information Security; Object-Oriented Programming; Internets; Data Processing

20000073713 Naval Postgraduate School, Monterey, CA USA
Development of a Quality Management Metric (QMM) Measuring Software Program Management Quality
Machniak, Martin J.; Dec. 1999; 155p; In English
Report No.(s): AD-A374316; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche
The quality of software management in a development program is a major factor in determining the success of a program. The four main areas where a software program manager can affect the outcome of a program are requirements management, estimation/planning management, people management, and risk management. by using current researched practices, interviews with senior program managers, and focus group data, the thesis examines the four areas for practices and structure that a software program manager may implement to positively affect the program. The thesis develops a Quality Management Metric (QMM) to measure the performance of the software manager. The QMM score is determined via a survey consisting of a two part questionnaire for each of the four main areas examined. The thesis evaluated three software programs for a QMM score. Informal verification and validation of the metric compared the QMM percentile score to an overall program success score and yielded positive correlation. The establishment of this methodology to quantify the quality of software management is an important step in evaluation of how past and current programs are managed and can serve as a template to improve software management performance in the future.
DTIC
Software Engineering; Quality Control; Computer Systems Programs; Management Planning

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also 54 Man/System Technology and Life Support.

20000068976 Army Research Lab., Sensors and Electron Devices Directorate, Adelphi, MD USA
Clutter Rejection Using Eigenspace Transformation *Interim Report, Oct. 1998 - Apr. 1999*
Chan, Lipchen A.; Nasrabadi, Nasser M.; Aug. 1999; 37p; In English
Contract(s)/Grant(s): Proj-A305
Report No.(s): AD-A368295; ARL-TR-1997; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The goal of our research is to develop an effective and efficient duller rejector with the use of an eigenspace transformation and a multilayer perception (MLP) that can be incorporated into an automatic target recognition (ATR) system. An eigenspace transformation is used for feature extraction and dimensionality reduction. The transformations considered in this research are principal component analysis (PCA) and the eigenspace separation transform (EST). We fed the result of the eigenspace transformation to an MLP that predicts the identity of the input, which is either a target or clutter. Cur proposed clutter rejector was tested on two huge and realistic datasets of second generation forward-looking infrared (FLIR) imagery for the Comanche helicopter. In general, both the PCA and EST methods performed satisfactorily with minor differences. The EST method performed slightly better when a smaller amount of transformed data were fed to the MLP, or when the positive and negative EST eigentargets were used together.
DTIC
Clutter; Rejection

20000069034 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA

Manipulation of Pose Distributions

Moll, Mark; Erdmann, Michael A.; Mar. 13, 2000; 36p; In English

Contract(s)/Grant(s): IRI-9503648

Report No.(s): AD-A376871; CMU-CS-00-111; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

For assembly tasks parts often have to be oriented before they can he put in an assembly. The results presented in this report are a component of the automated design of parts orienting devices. The focus is an orienting parts with minimal sensing and manipulation. We present a new approach to parts orienting through the manipulation of pose distributions. Through dynamic simulation we can determine the pose distribution for an object being dropped from an arbitrary height onto an arbitrary surface. by varying the drop height and the shape of the support surface we can find the initial conditions that will result in a pose distribution with minimal entropy. We are trying to uniquely orient a part with high probability just by varying the initial conditions. We will dervice a condition on the pose and velocity of an object in contact with a sloped surface that will allow us to quickly determine the final resting configuration of the object. This condition can then be used to quickly compute the pose distribution. We also present simulation and experimental results that show how dynamic simulation can be used to find optimal shapes and drop heights for a given part.

DTIC

Manipulators; Orientation; Drop Tests; Drop Size

20000070326 Naval Postgraduate School, Monterey, CA USA

Signal Classification Using The Mean Separator Neural Network

San Pedro, Miguel; Mar. 2000; 216p; In English

Report No.(s): AD-A377744; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The explosion of digital technology provides the warrior with the potential to exploit the battlespace in ways previously unknown. Unfortunately, this godsend is a two-edge sword. Although it promises the military commander greater situational awareness, the resulting tidal wave of data impairs his decision-making capacity. More data is not needed; enhanced information and knowledge are essential. This study built upon the Mean Separator Neural Network (MSNN) signal classification tool originally proposed by Duzenli (1998) and modified it for increased robustness. MSNN variants were developed and investigated. One modification involved input data preconditioning prior to neural network processing. A second modification incorporated projection space variance into a redefined performance parameter and in a newly defined training termination criterion. These alternative MSNN architectures were measured against the standard MSNN, a single-layer perceptron, and a statistical classifier using data of varying input dimensionality and noise power. Classification simulations performed using these techniques measured the accuracy in categorizing data objects composed of artificial features and features extracted from synthetic communication signals. The projection space modification variant exceeded all classifiers under noise-free conditions and performed comparably to the standard MSNN in noisy environments. The preconditioned input method produced a poorer response under most situations.

DTIC

Signal Analysis; Signal Processing; Neural Nets; Classifications; Simulation

20000070488 Technische Hogeschool Twente, Faculty of Applied Mathematics, Enschede, Netherlands

Efficient Simulation of Backlogs in Fluid Flow Lines

Kroese, D. P.; Nicola, V. F.; November 1997; ISSN 0169-2690; 24p; In English

Report No.(s): PB2000-104896; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

An Importance Sampling procedure to efficiently estimate overflow probabilities in continuous flow lines is described. The corresponding change of measure is found by generalizing the procedure that yields the change of measure for an ordinary fluid queue. Empirical results demonstrate the validity and effectiveness of the approach.

NTIS

Continuum Flow; Data Flow Analysis

20000070747 Purdue Univ., School of Electrical Engineering, West Lafayette, IN USA

Robust Gain-Scheduled Nonlinear Control Design for Stability and Performance *Final Report, 1 May 1997-30 Apr 2000*

Balakrishnan, Venkataramanan, Purdue Univ., USA; Apr. 30, 2000; 126p; In English

Contract(s)/Grant(s): N00014-97-1-0640

Report No.(s): AD-A377873; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

The models of control systems encountered in many naval applications are nonlinear; moreover, they are also time varying, and have uncertainties affecting them. The underlying controller design problems, beyond requiring system stability, also typi-

cally require the optimization of some performance objectives. We propose a numerical solution methodology for solving the general nonlinear controller design problem. The proposed controller architecture is gain scheduled (i.e., the controller uses the measured nonlinearities and time-variations), and optimizes the worst-case performance over the uncertainties of the system. The search for the optimal controller parameters can be reformulated as convex optimization problems involving linear matrix inequalities in several important cases. The design methods are demonstrated on models of Unmanned Combat Air Vehicles (UCAVs). We also address robust estimation problems that underlie many naval applications in control, communications and signal processing areas. Traditional estimation algorithms are based on a nominal system model without uncertainty. However, in many cases, there exist uncertainties in model parameters that may degrade the estimation performance of traditional non-robust algorithms. We present an adaptive robust Kalman filtering algorithm that addresses robustness issues in estimation problems that arise in linear time-varying systems with stochastic parametric uncertainties.
DTIC

Adaptive Control; Nonlinear Systems; Control Theory; Robustness (Mathematics); Control Systems Design; Signal Processing; Control Stability; Controllers; Design Analysis

20000072470 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA

Probabilistic Algorithms in Robotics

Thrun, Sebastian; Apr. 2000; 21p; In English

Contract(s)/Grant(s): DAAE07-98-C-L032; F30602-98-2-0137

Report No.(s): AD-A376946; CMU-CS-00-126; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    This article describes a methodology for programming robots known as probabilistic robotics. The probabilistic paradigm pays tribute to the inherent uncertainty in robot perception, relying on explicit representations of uncertainty when determining what to do. This article surveys some of the progress in the field, using in-depth examples to illustrate some of the nuts and bolts of the basic approach. Our central conjecture is that the probabilistic approach to robotics scales better to complex real-world applications than approaches that ignore a robot's uncertainty.
DTIC

Algorithms; Robots; Computer Programming; Robotics

20000072568 NASA Langley Research Center, Hampton, VA USA

Active Control Technology at NASA Langley Research Center

Antcliff, Richard R., NASA Langley Research Center, USA; McGowan, Anna–Marie R., NASA Langley Research Center, USA; [2000]; 16p; In English; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles, 8-11 May 2000, Braunschweig, Germany; Sponsored by North Atlantic Treaty Organization, Unknown; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    NASA Langley has a long history of attacking important technical Opportunities from a broad base of supporting disciplines. The research and development at Langley in this subject area range from the test tube to the test flight, The information covered here will range from the development of innovative new materials, sensors and actuators, to the incorporation of smart sensors and actuators in practical devices, to the optimization of the location of these devices, to, finally, a wide variety of applications of these devices utilizing Langley's facilities and expertise. Advanced materials are being developed for sensors and actuators, as well as polymers for integrating smart devices into composite structures. Contributions reside in three key areas: computational materials; advanced piezoelectric materials; and integrated composite structures.
Derived from text

Active Control; Actuators; Piezoelectricity; Piezoelectric Gages; Smart Materials; Shape Memory Alloys

20000073317 Lehigh Univ., Dept. of Computer Science and Electrical Engineering, Bethlehem, PA USA

A Theory for Distributed Signal Detection and Data Fusion *Final Report, Jun 1997-May 2000*

Blum, Rick S.; May 16, 2000; 17p; In English

Contract(s)/Grant(s): N00014-97-1-0774

Report No.(s): AD-A377472; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    This research attempts to develop a fundamental understanding of the issues involved in the design and performance analysis of distributed detection schemes. Such knowledge is currently lacking. This is especially true for cases with statistically dependent observations from sensor to sensor, a practical case on which this research focuses. Some emphasis is being devoted to developing design algorithms and on applications. The goal of these studies is to produce tools and techniques for pressing

practical problems. We classify our efforts into four basic areas: properties of dependent observations cases, design algorithms, applications and image fusion.

DTIC

Multisensor Fusion; Signal Processing; Distributed Processing

20000073725 Massachusetts Inst. of Tech., Cambridge, MA USA

Advances in Grasping and Vehicle Contact Identification: Analysis, Design and Testing of Robust Methods for Underwater Robot Manipulation

Snow, Edward R.; Jun. 1999; 231p; In English; Prepared in cooperation with Woods Hole Oceanographic Inst., Woods Hole, MA.

Contract(s)/Grant(s): OCE-9216775; N00014-95-1-0464

Report No.(s): AD-A376767; MIT/WHOI-99-11; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This thesis focuses on improving the productivity of autonomous and telemanipulation systems consisting of a manipulator arm mounted to a free flying underwater vehicle. Part I minimizes system sensitivity to misalignment by developing a gripper and a suite of handles that passively self align when grasped. After presenting a gripper guaranteed to passively align cylinders we present several other self aligning handles. The mix of handle alignment and load resisting properties enables handles to be matched to the needs of each task. Part I concludes with a discussion of successful field use of the system on the Jason Remotely Operated Undersea Vehicle operated by the Woods Hole Oceanographic Institution. to enable the exploitation of contact with the environment to help stabilize the vehicle, Part II develops a technique which identifies the contact state of a planar vehicle interacting with a fixed environment. Knowing the vehicle geometry and velocity we identify kinematically feasible contact points, from which we construct the set of feasible contact models. The measured vehicle data violates each model's constraints; we use the associated violation power and work to select the best overall model. Part II concludes with experimental confirmation of the contact identification technique's efficacy.

DTIC

Underwater Vehicles; Robots; Manipulators; End Effectors; Teleoperators

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20000068969 Technische Hogeschool Twente, Faculty of Applied Mathematics, Enschede, Netherlands

Homoclinic Twist Bifurcation in a System of Two Coupled Oscillators

vanGils, S. A.; Krupa, M.; Tchistiakov, V.; Jul. 07, 1997; 76p; In English

Report No.(s): PB2000-104900; No Copyright; Avail: National Technical Information Service (NTIS)

The qualitative analysis of the dynamics in the vicinity of a homoclinic twist point in a two parameter family of $Z(sub\ 2)$-symmetric automonomous ordinary differential equations in four dimensions has been performed. A variant of the Lyapunov-Schmidt reduction method has been used to prove the existence of n times winding homoclinic loops, periodic orbits limiting on these homoclinic orbits and non-periodic orbits. Theoretical results supplement numerical results on the computation of nonsymmetric homoclinic orbits in a system of two Josephson junctions, in order to check the relevance of these computations.

NTIS

Oscillators; Qualitative Analysis; Branching (Mathematics)

20000070487 Technische Hogeschool Twente, Faculty of Applied Mathematics, Enschede, Netherlands

Compensative Block Incomplete Factorizations 2

Lu, H.; November 1997; ISSN 0169-2690; 30p; In English

Report No.(s): PB2000-104895; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Two approaches of improving compensative block incomplete factorization (CBILU) are presented. The purpose of these improvements is to enable the parallel construction of preconditioners and to enable application to three dimensional problems for elliptic equations. The CBILU with the diagonally compensative inverse is improved by a double approach using the sparse compensative inverse. A two-fold CBILU to cope with the difficulties arising from block incomplete factorizations of modified block incomplete factorizations for three dimensional problems is proposed. It is proved that all algorithms proposed in this paper

are well-defined. Numerical examples for both two and three dimensional problems are presented. For three dimensional problems the two-fold CBILU shows similar behavior to the CBILU for two dimensional problems.
NTIS

Factorization; Elliptic Differential Equations; Matrices (Mathematics)

20000072438 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Geometrical Approach to Bell's Theorem

Rubincam, David Parry, NASA Goddard Space Flight Center, USA; Mar. 31, 2000; 27p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Bell's theorem can be proved through simple geometrical reasoning, without the need for the Psi function, probability distributions, or calculus. The proof is based on N. David Mermin's explication of the Einstein-Podolsky-Rosen-Bohm experiment, which involves Stern-Gerlach detectors which flash red or green lights when detecting spin-up or spin-down. The statistics of local hidden variable theories for this experiment can be arranged in colored strips from which simple inequalities can be deduced. These inequalities lead to a demonstration of Bell's theorem. Moreover, all local hidden variable theories can be graphed in such a way as to enclose their statistics in a pyramid, with the quantum-mechanical result lying a finite distance beneath the base of the pyramid.
Author

Theorems; Quantum Mechanics; Theorem Proving

20000072499 Air Force Inst. of Tech., School of Engineering, Wright-Patterson AFB, OH USA

Factoring Large Numbers: Stealing Your Secrets

Currie, Kevin S.; Apr. 18, 2000; 18p; In English

Report No.(s): AD-A377327; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this research has been to explore the methods and techniques currently used to factor large numbers. The RSA cryptosystem employs large numbers which are the product of two primes to encrypt and decrypt private messages. In order to break these codes, the first step is to factor the large public integer n into its two primes. Although there are many methods to factor these large integers, most are time consuming and may take decades or centuries to complete. The algorithms undertaken in this project are the predominate methods in use today and include the Pollard p-1 and the Quadratic Sieve. These methods are powerful and have the ability to factor large numbers. In order to accomplish these algorithms, the brute force method and the pseudoprime tests must be implemented and they are included in the research as well. The paper includes the methods for an intruder to steal the information sent over insecure lines of communication. In addition, it instructs the order in which the intruder should attempt to break the code, starting with the easiest methods first and then moving to more complicated and time consuming techniques.
DTIC

Cryptography; Factorization; Decoding; Number Theory

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series and analysis; and stochastic processes.

20000070493 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA

Robust Monte Carlo Localization for Mobile Robots

Thrun, Sebastian; Fox, Dieter; Burgard, Wolfram; Dellaert, Frank; Apr. 2000; 42p; In English

Report No.(s): AD-A376945; CMU-CS-00-125; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Mobile robot localization is the problem of determining a robot's pose from sensor data. Monte Carlo Localization is a family of algorithms for localization based on particle filters, which are approximate Bayes filters that use random samples for posterior estimation. Recently, they have been applied with great success for robot localization. Unfortunately, regular particle filters perform poorly in certain situations. Mixture-MCL, the algorithm described here, overcomes these problems by using a "dual" sampler, integrating two complimentary ways of generating samples in the estimation. to apply this algorithm for mobile robot localization, a kd-tree is learned from data that permits fast dual sampling. Systematic empirical results obtained using data collected in crowded public places illustrate superior performance, robustness, and efficiency, when compared to other state-of-the-art localization algorithms.
DTIC

Monte Carlo Method; Robots; Bayes Theorem; Samplers

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20000068438 Institute for Human Factors TNO, Soesterberg, Netherlands

The Effectiveness of Crisis Teams: An Empirical Study *Interim Report De Effectiviteit van Crisisteams: Een Empirisch Onderzoek*

Griffioen–Young, H. J., Institute for Human Factors TNO, Netherlands; Hoeksema–vanOrden, C. Y. D., Institute for Human Factors TNO, Netherlands; Essens, P. J. M. D., Institute for Human Factors TNO, Netherlands; Jan. 20, 2000; 27p; In Dutch
Contract(s)/Grant(s): A98/KLu/326; TNO Proj. 731.2
Report No.(s): TD-00-0108; TM-00-A005; Copyright; Avail: Issuing Activity

Earlier this year a literature study was published in which factors contributing to increased team effectiveness were mapped out. In a continuation of this line of research, the Netherlands Air Force has contracted TNO-HFR1 to evaluate the effectiveness of crisis teams in an effort to increase team effectiveness and thus the quality of crisis control efforts. The present report describes a study in which team effectiveness was evaluated during the execution of a crisis control simulation game (CRISISLAB). Observations of the Operational Team and the Policy Team in terms of shortcomings in team effectiveness were carried out. In addition, participants completed questionnaires evaluating the existence, frequency and impact of problems in the team effort. The results show that the primary problem areas are communication, both in terms of the information people receive and the communication lines, and coordination in terms of team structure and responsibilities. The results of the present study are discussed in terms of the team effectiveness model, as presented in the earlier literature study. Finally, directions for future research are discussed.
Author
Numerical Analysis; Effectiveness; Teams; Research; Control Simulation

20000068523 Naval Postgraduate School, Dept. of Operations Research, Monterey, CA USA

An Integer-Linear Program to Plan Procurement and Deployment of Space and Missile Assets
Newman, Alexandra M.; Brown, Gerald G.; Dell, Robert F.; Giddings, Angela; Rosenthal, Richard E.; Apr. 2000; 36p; In English
Report No.(s): AD-A376820; NPS-OR-00-005; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Space Command Optimizer of Utility Toolkit (SCOUT) is an integer linear program used by the Air Force Office of Aerospace Studies to help plan the research and development of space-based systems over a 25-year horizon. SCOUT recommends a mix of concepts, current systems, and launches that minimizes shortfalls in task performance while adhering to constraints on budget, launcher demand, launcher availability, and logic governing the precedence and interdependence of systems. This technical report provides a mathematical description of SCOUT, details several modifications, and reports computational experience. We find a significant reduction in solution time by using discount factors, and introducing the notion of continuous-valued research and development concepts.
DTIC
Linear Programming; Computer Programs; Missiles; Project Planning; Aerospace Systems

20000069860 Rutgers Univ., Operations Research Center, Newark, NJ USA

Decision Support Tools for Aircraft Operations Planning with Many Practical Constraints *Final Report, Feb. 1997-Jul. 1999*

Lei, Lei, Rutgers Univ., USA; Mar. 2000; 67p; In English
Contract(s)/Grant(s): F30602-97-1-0043; AF Proj. 2304
Report No.(s): AD-A377610; AFRL-IF-RS-TR-2000-33; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

In this project, decision support tools for aircraft operations planning under many practical constraints were developed. The application that motivated this study was the aircraft planning and logistics planning and scheduling that occurred during the planning of operations such as Desert Storm and the Somalia effort. This report describes a family of mathematical models and computation procedures that can be used as decision support tools for aircraft operations planning with many practical constraints. The major advantage of this planning tool is that it is able to find the minimum-cost plan under many complex constraints without the need to solve any mathematical program. The resulting planning process is an iterative process.
DTIC
Flight Operations; Mathematical Models; Decision Support Systems; Project Planning; Constraints

20000073230 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
SIRTF Science Operations System Design
Green, William, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; Astronomical Data Analysis Software and Systems, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

SIRTF Science Operations System Design William B. Green Manager, SIRTF Science Center California Institute of Technology M/S 310-6 1200 E. California Blvd., Pasadena CA 91125 (626) 395 8572 Fax (626) 568 0673 bgreen@ipac.caltech.edu. The Space Infrared Telescope Facility (SIRTF) will be launched in December 2001, and perform an extended series of science observations at wavelengths ranging from 20 to 160 microns for five years or more. The California Institute of Technology has been selected as the home for the SIRTF Science Center (SSC). The SSC will be responsible for evaluating and selecting observation proposals, providing technical support to the science community, performing mission planning and science observation scheduling activities, instrument calibration during operations and instrument health monitoring, production of archival quality data products, and management of science research grants. The science payload consists of three instruments delivered by instrument Principal Investigators located at University of Arizona, Cornell, and Harvard Smithsonian Astrophysical Observatory. The SSC is responsible for design, development, and operation of the Science Operations System (SOS) which will support the functions assigned to the SSC by NASA. The SIRTF spacecraft, mission profile, and science instrument design have undergone almost ten years of refinement. SIRTF development and operations activities are highly cost constrained. The cost constraints have impacted the design of the SOS in several ways. The Science Operations System has been designed to incorporate a set of efficient, easy to use tools which will make it possible for scientists to propose observation sequences in a rapid and automated manner. The use of highly automated tools for requesting observations will simplify the long range observatory scheduling process, and the short term scheduling of science observations. Pipeline data processing will be highly automated and data-driven, utilizing a variety of tools developed at JPL, the instrument development teams, and Space Telescope Science Institute to automate processing. An incremental ground data system development approach has been adopted, featuring periodic deliveries that are validated with the flight hardware throughout the various phases of system level development and testing. This approach minimizes development time and decreases operations risk. This paper will describe the top level architecture of the SOS and the basic design concepts. A summary of the incremental development approach will be presented. Examples of the unique science user tools now under final development prior to the first proposal call scheduled for mid-2000 will be shown.
Author
Systems Engineering; Space Infrared Telescope Facility; Data Management; Data Systems; Ground Tests; Astrophysics; Data Processing

20000073314 Naval Postgraduate School, Monterey, CA USA
The K-Group Maximum-Flow Network-Interdiction Problem
Akgun, Ibrahim; Mar. 2000; 58p; In English
Report No.(s): AD-A377500; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We study the K-group network-interdiction problem (KNIP) in which a "network user" attempts to maximize flow among K is greater than or = 3 "node groups", while an "interdictor" interdicts (destroys) network arcs, using limited interdiction resources, to minimize this maximum flow. We develop two models to solve or approximately solve KNIP. The multi-partition network-interdiction model (MPNIM) is an approximating model. It partitions the node set N into K different subsets, each containing one prespecified node group, and interdicts arcs using limited resources so that the total capacity of uninterdicted arcs crossing between subsets is minimized. The multi-commodity network-interdiction model (MCNIM) explicitly minimizes the maximum amount of flow that can potentially be moved among node groups using K single-commodity flow models connected by joint capacity constraints. It is a min-max model but is converted into an equivalent integer program MCNIM-IP. Both MPNIM and MCNIM-IP are tested using four artificially constructed networks with up to 126 nodes, 333 arcs, K = 5, and 20 interdictions allowed. Using a 333 MHz Pentium II personal computer, maximum solution times are 563.1 seconds for MPNIM but six of 16 MCNIM-IP problems cannot be solved in under 3,600 seconds.
DTIC
Mathematical Models; Computer Programming; Stochastic Processes

20000073319 Army War Coll., Carlisle Barracks, PA USA
Army Aviation as an Element of Airpower
Lawrence, David L.; Apr. 10, 2000; 31p; In English
Report No.(s): AD-A377470; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper demonstrates that the Army must embrace jointness to affect future employment of its attack helicopters as an element of airpower. To accommodate the joint employment of these aircraft, Army doctrine must evolve beyond dated, Cold War

doctrine that restricts helicopters to exclusive support of the land component. Analysis of the air campaign in Kosovo serves to illustrate a missed opportunity to start the doctrinal evolution. In this conflict, the Army arrived in theater unprepared to conduct its assigned airpower mission. by the time they were ready to fight, the nature of the conflict changed sufficiently to render attack helicopters unnecessary. A solution, to remedy future scenarios, is to assign joint operational missions to the Army's corps aviation brigades and attack helicopter regiments, similar to maritime interdiction missions flown by 6th Cavalry Brigade in Korea. In addition to joint doctrinal evolution, if the Army is to achieve relevancy as an element of airpower, it must make changes to its attack helicopter force structure. A shift in training focus and willingness within the Army to subordinate attack helicopters to other components of the joint force, particularly the Joint Force Air Component Commander (JFACC), will assure their airpower role.
DTIC
Military Helicopters; Education

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology set theory, group theory and and number theory.

20000068967 Technische Univ., Dept. of Mathematics and Computing Science, Eindhoven Netherlands
Renewal Theory and Level Passage by Subordinators
Bertoin, J.; vanHarn, K.; Steutel, F. W.; Jun. 1997; 14p; In English
Report No.(s): PB2000-104938; MEMO-COSOR-97-15; No Copyright; Avail: National Technical Information Service (NTIS)
    Use of limit theorems for renewal processes generated by infinitely divisible life times very easily leads to formulas (not proofs) for the limit distributions of the 'undershoot' and 'overshoot' at the passage of a level by subordinators. These formulas are then proved.
NTIS
Theorems; Theorem Proving

20000070489 Technische Hogeschool Twente, Faculty of Applied Mathematics, Enschede, Netherlands
Implicit Hamiltonian Systems with Symmetry
vanderSchaft, A. J.; August 1997; ISSN 0169-2690; 24p; In English
Report No.(s): PB2000-104898; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
    Implicit Hamiltonian systems with symmetry are treated by exploiting the notion of symmetry of Dirac structures. It is shown how Dirac structures can be reduced to Dirac structures on the orbit space of symmetric group, leading to a reduced implicit (generalized) Hamiltonian system. The approach is specialized to nonholonomic mechanical systems with symmetry.
NTIS
Hamiltonian Functions; Symmetry

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see categories 71 through 77. For related instrumentation see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.

20000069352 National Inst. of Standards and Technology, Manufacturing Engineering Lab., Gaithersburg, MD USA
SIMnet Design and Internet Deployment Guide
Schneeman, R. D.; Dec. 1999; 1p; In English
Report No.(s): PB2000-101781; NISTIR-6452; No Copyright; Avail: National Technical Information Service (NTIS)
    This new Internet-based pilot Metrology system is called SIMnet after its implementation within the Interamerican Metrology System (SIM). After reading this document, the reader will be familiar with the software and hardware that make up the SIMnet system as well as the standards used to support the multimedia conferencing technology. This document provides important background and system information for current SIMnet users and administrators. In addition, those interested in setting up and deploying SIMnet-like environments can use this document as a comprehensive deployment guide. Finally, the document describes enough about the underlying technology of the SIMnet system to provide the reader with relevant broad-based knowl-

edge of the technical portions of the system. This document contains: an introduction to SIM and the SIMnet pilot system; a description of the requirements and design that led to the SIMnet pilot system; the standards and technology used throughout the SIMnet definition process; an overview of the components and products used to realize this new system; strategies for selecting the right combination of hardware and software for deployment; a design methodology for enhancing data-centric applications in the metrology area; discussions on technical support, training, security, and firewall issues with SIMnet; and an in-depth discussion of how to connect to and participate in the current SIMnet system.

NTIS

Internets; Computer Programs; Deployment; Metrology; Computer Systems Design

20000070446 Air Force Research Lab., Directed Energy Directorate, Kirkland AFB, NM USA

A Three-Dimensional Finite Difference Time Domain: Perfectly Matched Layer Algorithm for Nonlinear Dispersive Media *Final Report, 1 Oct. 1999-10 Mar. 2000*

Yakura, S. Joe, Air Force Research Lab., USA; Mar. 10, 2000; 38p; In English

Contract(s)/Grant(s): Proj-5797

Report No.(s): AD-A377907; AFRL-DE-TR-2000-1031; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Starting with unsplit-field uniaxial perfectly matched layer (PML) formulation, a second-order accurate finite difference time domain. Perfectly matched layer (FDTD-PML) algorithm is obtained for the first time using the piecewise-linear approximation for nonlinear dispersive PML media. In the absence of the PML interface, the nonlinear dispersive FDTD-PML algorithm reduces to the usual nonlinear dispersive FDTD algorithm.

DTIC

Algorithms; Finite Difference Time Domain Method; Perfectly Matched Layers; Maxwell Equation; Computational Electromagnetics

20000070673 Institute of Nuclear Chemistry and Technology, Warsaw, Poland

Annual Report of Institute of Nuclear Chemistry and Technology 1997

Jun. 30, 1998; 162p; In English

Report No.(s): DE99-602961; INIS-PL-98-007; No Copyright; Avail: Department of Energy Information Bridge

The report is the collection of short communications being the review of the scientific activity of Institute of Nuclear Chemistry and Technology - Warsaw in 1997. The papers are gathered in several branches as follows: radiation chemistry and physics; radiochemistry, stable isotopes, nuclear analytical methods, chemistry in general; radiobiology; nuclear technologies and methods. The annual report of INCT-1997 contains also the general information about INCT as well as the full list of scientific papers being published by the staff in 1997.

NTIS

Nuclear Chemistry; Radiation Chemistry; Research

20000070682 NASA Marshall Space Flight Center, Huntsville, AL USA

Suppression/Reversal of Natural Convection by Exploiting the Temperature/Composition Dependence of Magnetic Susceptibility

Seybert, C. D., California Univ., USA; Evans, J. W., California Univ., USA; Leslie, F., NASA Marshall Space Flight Center, USA; Jones, W. K., Jr., Motorola, Inc., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Natural convection, driven by temperature-or concentration gradients or both, is an inherent phenomenon during solidification of materials on Earth. This convection has practical consequences (e.g effecting macrosegregation) but also renders difficult the scientific examination of diffusive/conductive phenomena during solidification. It is possible to halt, or even reverse, natural convection by exploiting the variation (with temperature, for example) of the susceptibility of a material. If the material is placed in a vertical magnetic field gradient, a buoyancy force of magnetic origin arises and, at a critical field gradient, can balance the normal buoyancy forces to halt convection. At higher field gradients the convection can be reversed. The effect has been demonstrated in experiments at Marshall Space Flight Center where flow was measured by PIV in MnCl2 solution in a superconducting magnet. In auxiliary experiments the field in the magnet and the properties of the solution were measured. Computations of the natural convection, its halting and reversal, using the commercial software FLUENT were in good agreement with the measurements.

Author

Free Convection; Magnetic Permeability; Temperature Dependence; Retarding; Reversed Flow

NASA Marshall Space Flight Center, Huntsville, AL USA
Particle Engulfment and Pushing by Solidifying Interfaces
Stefanescu, D. M., Alabama Univ., USA; Mukherjee, S., Alabama Univ., USA; Juretzko, F. R., Alabama Univ., USA; Catalina, A. V., University Space Research Alliance, USA; Sen, S., University Space Research Alliance, USA; Curreri, P. A., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Materials Science, 7 Jun. 2000, Huntsville, AL, USA
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

The phenomenon of interaction of particles with solid-liquid interfaces (SLI) has been studied since mid 1960's. While the original interest stemmed from geology applications (frost heaving in soil), researchers soon realized that fundamental understanding of particles behavior at solidifying interfaces might yield practical benefits in other fields, including metallurgy. In materials engineering the main issue is the location of particles with respect to grain boundaries at the end of solidification. Considerable experimental and theoretical research was lately focused on applications to metal matrix composites produced by casting or spray forming techniques, and on inclusion management in steel. Another application of particle SLI interaction is in the growing of Y1Ba2Cu3O(7-delta) (123) superconductor crystals from an undercooled liquid. The oxide melt contains Y2Ba1Cu1O5 (211) precipitates, which act as flux pinning sites.
Derived from text
Particle Interactions; Solidification; Casting; Sprayers; Forming Techniques

NASA Marshall Space Flight Center, Huntsville, AL USA
Current-Produced Magnetic Field Effects on Current Collection
Khazanov, G. V., Alaska Univ., USA; Stone, N. H., NASA Marshall Space Flight Center, USA; Krivorutsky, E. N., Alaska Univ., USA; Liemohn, M. W., Michigan Univ., USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Current collection by an infinitely long, conducting cylinder in a magnetized plasma, taking into account the magnetic field of the collected current, is discussed. A region of closed magnetic surfaces disconnects the cylinder from infinity. Due to this, the collected current depends on the ratio between this region and the plasma sheath region and, under some conditions, current reduction arises. It is found that the upper-bound limit of current collection is reduced due to this change of magnetic field topology. The effect can be essential even if the orbit-limited model of current collection is valid. This model is used to find the reduction of the total current collected by a cylinder (e.g., a bare tether). Such effect strongly depends on plasma density. The results are applied to a tether system in the ionosphere. For this case, it is found that current reduction can be significant for long tethers in typical dayside ionospheric conditions.
Author
Magnetic Fields; Magnetic Effects; Magnetic Field Configurations; Plasma Physics; Plasmas (Physics); Current Sheets

Illinois Univ., Dept. of Theoretical and Applied Mechanics, Urbana, IL USA
Coupled Elastic Surface Wave in Curved Structures *Final Report, May 1996-Nov 1999*
Harris, John G.; Feb. 11, 2000; 8p; In English
Contract(s)/Grant(s): F49620-96-1-0190
Report No.(s): AD-A374339; AFRL-SR-BL-TR-00-0037; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A mathematical description of coupled. surface-wave propagation in elastic waveguides whose properties change slowly in the lateral or transverse directions has been constructed. This construction includes curved waveguides (shells) whose radius of curvature is large with respect to thickness. The work was undertaken to explore a nondestructive way to interrogate an inaccessible side of a structure by launching a surface wave on the other accessible side. For flat waveguides (plates) whose thickness varies slowly in the propagation direction the surface waves couple very efficiently provided the thickness is on the order of a wavelength, but as the waveguide grows in thickness the coupling is quickly lost. The coupling in a curved waveguide occurs provided the ratio thickness to radius of curvature is of the order of 1/20 and the thickness is on the order of a wavelength.
DTIC
Surface Waves; Wave Propagation; Waveguides; Ultrasonic Radiation; Rayleigh Waves; Nondestructive Tests; Flat Plates; Elastic Waves; Construction

Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution. For aircraft noise see also 02 Aerodynamics and 07 Aircraft Propulsion Propulsion and Power.

20000068518 Wyle Labs., Inc., Arlington, VA USA

Validation of Aircraft Noise Prediction Models at Low Levels of Exposure

Page, Juliet A., Wyle Labs., Inc., USA; Hobbs, Christopher M., Wyle Labs., Inc., USA; Plotkin, Kenneth J., Wyle Labs., Inc., USA; Stusnick, Eric, Wyle Labs., Inc., USA; April 2000; 102p; In English

Contract(s)/Grant(s): NAS1-20103; RTOP 538-03-15-01

Report No.(s): NASA/CR-2000-210112; NAS 1.26:210112; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Aircraft noise measurements were made at Denver International Airport for a period of four weeks. Detailed operational information was provided by airline operators which enabled noise levels to be predicted using the FAA's Integrated Noise Model. Several thrust prediction techniques were evaluated. Measured sound exposure levels for departure operations were found to be 4 to 10 dB higher than predicted, depending on the thrust prediction technique employed. Differences between measured and predicted levels are shown to be related to atmospheric conditions present at the aircraft altitude.

Author

Aircraft Noise; Noise Prediction (Aircraft); Prediction Analysis Techniques; Mathematical Models; Noise Measurement

20000069842 National Defence Research Establishment, Div. of Systems and Underwater Technology, Stockholm, Sweden

Acoustic Signature Reduction Using Feedback of Piezo-Electric Layers *Akustisk Signaturanpassning med Aterkopplade Piezoelektriska Skikt*

Hamberg, J.; Malmgren, A.; Dec. 1998; 82p; In Swedish

Report No.(s): PB2000-103085; FOA-R-98-00962-615-SE; No Copyright; Avail: National Technical Information Service (NTIS)

In this report, the possibilities of using feedback of piezo-electric layers for controlling the acoustic properties of a surface are investigated. The investigation shows that in principle it is possible to achieve desired properties (e.g. no reflection, artificial transparency, or simultaneous transmission and reception of information) using a single piezo-electric layer. This layer then operates both as a sensor and as an actuator. The study shows that this will work well, also in practice, if the material has a electro-mechanic coupling factor that is large enough. However, for the values of electro-mechanic coupling factors of available materials, the above construction is not suitable for practical purposes. Therefore, the possibility of using multiple layers is investigated also. It turns out that a two layer construction can achieve the properties of a single layer with large electro-mechanic coupling factor. For the specific problem of achieving no reflection, an explicit construction of a realistic controller is performed. Requirements of robust stability and limited voltage amplitudes, imply that low reflection cannot be achieved at low and high frequencies. However, for a large frequency interval it is possible to obtain low reflection. It is shown that both the gain and phase margins are infinite with this controller.

NTIS

Acoustic Properties; Controllers; Data Transmission; Electric Potential; Piezoelectricity

20000070855 Harris, Miller, Miller and Hanson, Inc., Burlington, MA USA

Examining INM Accuracy Using Empirical Sound Monitoring and Radar Data

Miller, Nicholas P., Harris, Miller, Miller and Hanson, Inc., USA; Anderson, Grant S., Harris, Miller, Miller and Hanson, Inc., USA; Horonjeff, Richard D., Harris, Miller, Miller and Hanson, Inc., USA; Kimura, Sebastian, Harris, Miller, Miller and Hanson, Inc., USA; Miller, Jonathan S., Harris, Miller, Miller and Hanson, Inc., USA; Senzig, David A., Harris, Miller, Miller and Hanson, Inc., USA; Thompson, Richard H., Harris, Miller, Miller and Hanson, Inc., USA; April 2000; 138p; In English

Contract(s)/Grant(s): NAS1-20102; RTOP 538-03-15-01

Report No.(s): NASA/CR-2000-210113; NAS 1.26:210113; HMMH-294520.03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Aircraft noise measurements were made using noise monitoring systems at Denver International and Minneapolis St. Paul Airports. Measured sound exposure levels for a large number of operations of a wide range of aircraft types were compared with predictions using the FAA's Integrated Noise Model. In general it was observed that measured levels exceeded the predicted levels by a significant margin. These differences varied according to the type of aircraft and also depended on the distance from the

aircraft. Many of the assumptions which affect the predicted sound levels were examined but none were able to fully explain the observed differences.
Author
Aircraft Noise; Noise Measurement; Radar Data; Monitors; Meteorological Parameters; Mathematical Models

20000072581 Georgia Inst. of Tech., Acoustics and Aerospace Technologies Branch, Atlanta, GA USA
Acoustic Absorption Characteristics of an Orifice With a Mean Bias Flow
Ahuja, K. K., Georgia Inst. of Tech., USA; Gaeta, R. J., Jr., Georgia Inst. of Tech., USA; DAgostino, M., Georgia Inst. of Tech., USA; 20000331; 31p; In English
Contract(s)/Grant(s): NAG1-1734
Report No.(s): GTRI-A5004/2000-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the study reported here was to acquire acoustic and flow data for numerical validation of impedance models that simulate bias flow through perforates. The impedance model is being developed by researchers at High Technology Corporation. This report documents normal incidence impedance measurements a singular circular orifice with mean flow passing through it. All measurements are made within a 1.12 inch (28.5 mm) diameter impedance tube. The mean flow is introduced upstream of the orifice (with the flow and incident sound wave travelling in the same direction) with an anechoic termination downstream of the orifice. Velocity profiles are obtained upstream of the orifice to characterize the inflow boundary conditions. Velocity in the center of the orifice is also obtained. All velocity measurements are made with a hot wire anemometer and subsequent checked with mass flow measurements made concurrently. All impedance measurements are made using the Two-Microphone Method. Although we have left the analysis of the data to the developers of the impedance models that simulate bias flow through perforate, our initial examination indicates that our results follow the trends consistent with published theory on impedance of perforates with a steady bias flow.
Derived from text
Absorptivity; Acoustic Attenuation; Impedance Measurement; Orifices; Steady Flow; Mathematical Models; Response Bias

20000073253 Naval Research Lab., Washington, DC USA
Coherent Acoustic Communications During the Littoral Warfare Advanced Development 99-1 Experiment
Al–Kurd, Azmi; Schindall, Jeffrey; May 22, 2000; 40p; In English
Report No.(s): AD-A377920; NRL/MR/7120--00-8424; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Coherent acoustic communication experiments were performed during the Littoral Warfare Advanced Development exercise in the Gulf of Mexico in February 1999 (LWAD 99-1). The Acoustic Communication (ACOMM) experiment was allotted four segments of 5 hours each and two segments of one hour each. The ACOMM waveforms were projected using two mid-frequency acoustic sources (F-80 and F-56) and received at multiple platforms using vertical line arrays (VLA), sonobuoys (SSQ-57A), a submerged acoustic receiver, and TAN/SQS-53C sonar system. The ACOMM modems were aboard the Sea Diver platform; both modems were in the receiving mode. The received signals were processed in situ and stored on DAT tapes and 8-mm TEAC tapes for post experimental analysis. The analysis of the LWAD 99-1 experiment data shows strong multipath acoustic propagation environment, the first arrival weaker than later arrivals, and low signal-to-noise ratio (SNR). The reception at the deep VLA's (Sea Diver and Edwin Link) was very weak (almost absent) throughout the experiment. Data analysis using single phone reception without diversity resulted in high bit error rate (BER). The BER was drastically reduced when 4-channel spatial diversity was implemented, provided that there was sufficient SNR (greater than 10 dB) and the Doppler shift estimate was accurate.
DTIC
Warfare; Underwater Communication; Acoustics; Coastal Currents; Coherent Radiation

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 Nuclear Physics.

20000068456 NASA Ames Research Center, Moffett Field, CA USA
A Coupled-Cluster Study of the Molecular Structure, Vibrational Spectrum, and Heats of Formation of XONO2 (X=H, F, Cl)
Lee, Timothy J., NASA Ames Research Center, USA; Journal of Physical Chemistry; Feb. 16, 1995, pp. 1943-1948; In English; Copyright; Avail: Issuing Activity

The equilibrium structures, harmonic vibrational frequencies, dipole moments, and IR intensities of nitric acid, fluorine nitrate, and chlorine nitrate have been investigated by using the singles and doubles coupled cluster method that also includes a perturbational estimate of the effects of connected triple excitations, CCSD(T). A standard triple-zeta double-polarized basis set was utilized. The equilibrium geometries and vibrational spectra of $HONO_2$ and $ClONO_2$ are shown to be in excellent agreement with the available experimental data. The ab initio vibrational spectrum of $FONO_2$ is also shown to be in excellent agreement with experiment. Unlike the FOOF and FON molecules, but similar to the cis- and trans-FONO molecules, $FONO_2$ is shown to possess normal bond distances. The bonding in $FONO_2$ is shown to be more similar to that in $ClONO_2$ than that in $HONO_2$, although there are still significant differences, especially in the partial atomic charges as deduced from Mulliken populations. This causes $FONO_2$ to possess almost no dipole moment, which is very different to both $HONO_2$ and $ClONO_2$. by using large atomic natural orbital basis sets, CCSD(T) energies are computed for four isodesmic reactions in order to determine an accurate heat of formation for $FONO_2$. Our best estimate for DELTA H(raised circle) (sub f,298) is 3.1 plus or minus 2.0 kcal/mol, indicating that the $F-ONO_2$ bond energy is 31.3 kcal/mol.

Author

Chlorine; Fluorine; Heat of Formation; Molecular Structure; Hydrogen; Nitrogen; Oxygen; Molecular Clusters

20000068913 NASA Ames Research Center, Moffett Field, CA USA

Finite-Element Z-Matrix Calculation of Electron-N2 Collisions

Huo, Winifred M., NASA Ames Research Center, USA; Dateo, Christopher E., Thermoscience Inst., USA; [1999]; 1p; In English; 21st; Physics of Electronic and Atomic Collisions, 22-27 Jul. 1999, Sendai, Japan

Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The finite element Z-matrix method has been applied in a multichannel study of e-N2 Collisions for electron energies from threshold to 30 eV. General agreement is obtained comparing with existing experimental and theoretical data. Some discrepancies are also found.

Author

Finite Element Method; Matrices (Mathematics); Matrix Methods; Electron Scattering; Collisions

20000068914 NASA Ames Research Center, Moffett Field, CA USA

Use of Relativistic Effective Core Potentials in the Calculation of Electron-Impact Ionization Cross Sections

Huo, Winifred M., NASA Ames Research Center, USA; Kim, Yong–Ki, National Inst. of Standards and Technology, USA; [1999]; 1p; In English; 21st; Physics of Electronic and Atomic Collisions, 22-27 Jul. 1999, Sendai, Japan

Contract(s)/Grant(s): RTOP 519-40-12; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Based on the Binary-Encounter-Bethe (BEB) model, the advantage of using relativistic effective core potentials (RECP) in the calculation of total ionization cross sections of heavy atoms or molecules containing heavy atoms is discussed. Numerical examples for Ar, Kr, Xe, and WF6 are presented.

Author

Electron Impact; Ionization Cross Sections; Molecules; Heavy Elements

20000068971 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Experiments with Single Trapped Ytterbium Ions at JPL

Yu, Nan, Jet Propulsion Lab., California Inst. of Tech., USA; Maleki, Lute, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents viewgraphs of experiments performed with single trapped Ytterbium ions. The topics include: 1) Ytterbium ion level scheme; 2) Paul-Straubel rf trap and single ion image; 3) D5/2 state lifetime measurement; 4) D3/2 state lifetime measurement; 5) Trapped individual ions in an optical cavity; 6) Initial exploratory system: experimental goals; and 7) Future systems: trap-cavity integration II.

CASI

Ions; Ytterbium; Ion Traps (Instrumentation)

20000070674 Istituto Nazionale di Fisica Nucleare, Lab. di Frascati, Rome, Italy

DEAR, FINUDA, KLOE: kaonic atoms, hypernuclei and CP-violation at the DA (Phi)NE(Phi)-Factory

Bianco, S.; Nov. 30, 1997; 19p; In English

Report No.(s): DE98-771754; LNF-P-97-040; No Copyright; Avail: Department of Energy Information Bridge

Physics at DA(Phi)NE, the new Frascati e(+)e(-) machine, is reviewed, as well as the experiments: DEAR - search for K N exotic atoms, FINUDA - spectroscopy and decays of hypernuclei, and KLOE - a multipurpose detector designed for detecting direct CP violation.

NTIS

Hypernuclei; Interferometers; Hadrons

20000073233 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Ultralow Energy Electron Attachment at Sub-Millielectron Volt Resolution

Chutjian, A., Jet Propulsion Lab., California Inst. of Tech., USA; Kortyna, A., Jet Propulsion Lab., California Inst. of Tech., USA; Darrach, M. R., Jet Propulsion Lab., California Inst. of Tech., USA; Howe, P. –T., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; 52nd; Gaseous Electronics, 5-8 Oct. 1999, Norfolk, VA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The technique of rare-gas photoionization has been extended by use of direct laser ionization to electron energies epsilon in the range 0-100 meV, with a resolution Delta(epsilon) of 0.4-0.5 meV (FWHM). Tunable UV light at (Lambda)276 nm is produced using a pulsed Nd:YAG laser and nonlinear mixing techniques. The beam is frequency tripled in a pulsed jet of xenon. The VUV radiation, tunable at (Lambda)92 nm, is then used to photoionize Xe at its 2P(sub 1/2) threshold (single-photon ionization). The photoelectrons produced interact with admixed target gas to generate negative ions through the s-wave capture process. Recent results in electron attachment to SF(sub 6) will be reported which show resonance structure at the opening of the ground-state vibrational channels. This structure corresponds to the process of vibrational excitation + attachment, which is superimposed on the underlying s-wave (direct) capture process. It should be a general phenomenon, present in a wide variety of zero-energy electron attaching molecules.

Author

Electron Energy; Ionization; Electron Attachment; Xenon; Photoionization; Pulsed Lasers; Photoelectrons

73
NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see 93 Space Radiation. For atomic and molecular physics see 72 Atomic and Molecular Physics. For elementary particle physics see 77 Physics of Elementary Particles and Fields. For nuclear astrophysics see 90 Astrophysics.

20000070478 Wisconsin Univ., Dept. of Physics, Madison, WI USA

Heavy Quarkonium Hadroproduction in the Color Evaporation Model

Smith, Christopher P., Wisconsin Univ., USA; Jan. 2000; 118p; In English

Report No.(s): AD-A377773; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

The primary goal of this thesis is to test the predictions of the Color Evaporation Model against the available hadroproduction data on the bottomonium system. As a secondary effort, it also applies each test to the model's predictions for the charmonium system in order to confirm and extend previous results and to identify any differences between the two heavy quarkonium systems. The analysis leads to three significant results. First, although it shows that the model can account for most of the available hadroproduction data, it identifies two potentially important behaviors in the charmonium system that the model fails to explain. Second, it refutes two significant assumptions made in some previous formulations of the model. Finally, it introduces a potentially useful technique to estimate the numerical values of the model's non-perturbative factors for states on which experimental data is not available.

DTIC

Evaporation; Mathematical Models; Quarks; Elementary Particles; Quantum Chromodynamics

20000073795 Istituto Nazionale di Fisica Nucleare, Frascati, Italy

Superconducting superstructure for the TESLA collider

Sekutowicz, J.; Tang, C.; Ferrario, M.; Apr. 30, 1998; 13p; In English

Report No.(s): DE99-722892; LNF-P-98-013; No Copyright; Avail: Department of Energy Information Bridge

The Authors discuss the new layout of a cavity chain (superstructure) allowing, the Authors hope, significant cost reduction of the RF system of both linacs of the TESLA linear collider. The proposed scheme increases the fill factor and thus makes an effective gradient of an accelerator higher. The authors present mainly computations that have performed up to now and which

encouraged to order the copper model of the scheme, still keeping in mind that experiments with a beam will be necessary to prove if the proposed solution can be used for the acceleration.

NTIS

Superconductivity; Cavities; Linear Accelerators

74
OPTICS

Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.

20000069001 NASA Ames Research Center, Moffett Field, CA USA

Terahertz Optical Gain Based on Intersubband Transitions in Optically-Pumped Semiconductor Quantum Wells: Coherent Pumped-Probe Interactions

Liu, Ansheng, Arizona State Univ., USA; Ning, Cun–Zheng, NASA Ames Research Center, USA; [1999]; 10p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Terahertz optical gain due to intersubband transitions in optically-pumped semiconductor quantum wells (QW's) is calculated nonperturbatively. We solve the pump- field-induced nonequilibrium distribution function for each subband of the QW system from a set of rate equations that include both intrasubband and intersubband relaxation processes. The gain arising from population inversion and stimulated Raman processes is calculated in a unified manner. We show that the coherent pump and signal wave interactions contribute significantly to the THz gain. Because of the optical Stark effect and pump-induced population redistribution, optical gain saturation at larger pump intensities is predicted.

Author

Quantum Wells; Semiconductors (Materials); Stark Effect

20000069032 Space and Naval Warfare Systems Center, San Diego, CA USA

Marine Aerosol Particles and Infrared Transmission

Zeisse, C. R.; Gathman, S. G.; Jensen, D. R.; Littfin, K. M.; Moision, W. K.; Sep. 1999; 3p; In English; Prepared in collaboration with University of Western Australia, Nedlands, Australia.

Report No.(s): AD-A376850; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The propagation of infrared radiation close to the ocean surface is controlled by three effects: (1) extinction (absorption and scattering) by aerosol particles, (2) extinction by molecules, and (3) refraction. Molecular extinction can be predicted with fair accuracy by transmission codes such as MODTRAN, and refraction can often be ignored along paths shorter than 10 km. Hence, by making continuous measurements of infrared transmission, a continuous record of aerosol transmission after removing the molecular transmission should be obtainable. This paper shows that this is indeed the case for mid- and longwave infrared transmission measured several meters above San Diego Bay.

DTIC

Aerosols; Marine Meteorology; Infrared Radiation; Ocean Surface

20000069358 National Inst. of Standards and Technology, Optoelectronics Div., Boulder, CO USA

Calibration Service for Spectral Responsivity of Laser and Optical-Fiber Power Meters at Wavelenghts between 0.4 mu m and 1.8 mu m

Lehman, J. H.; Dec. 1999; 52p; In English

Report No.(s): PB2000-102878; NIST/SP-250/53; No Copyright; Avail: National Technical Information Service (NTIS)

This document describes a calibration service for absolute spectral-responsivity measurements of laser power meters, optical-fiber power meters, and detectors used with lasers and optical-fiber connectors at wavelengths between 400 nm and 1800 nm. In addition to a summary of the calibration procedure, a theoretical basis is given for the uncertainty assessment, as well as an overview of the measurement system and operating procedures. A sample calibration report is included in this document that is similar to that which is provided to the customer. The calibration report contains absolute responsivity in terms of amps per watt at each wavelength increment and a summary of the uncertainty assessment for the meter.

NTIS

Calibrating; Spectrum Analysis; Laser Outputs

NASA Marshall Space Flight Center, Huntsville, AL USA

Cryogenic Optical Testing at the Marshall Space Flight Center

Eng, Ron, NASA Marshall Space Flight Center, USA; Stahl, Phil, NASA Marshall Space Flight Center, USA; Keidel, John, NASA Marshall Space Flight Center, USA; Kegley, Jeff, NASA Marshall Space Flight Center, USA; Geary, Joseph M., Alabama Univ., USA; [2000]; 1p; In English; Optical Fabrication and Testing, 18-24 Jun. 2000, Quebec, Canada; Sponsored by Optical Society of America, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Optical test results of several lightweight mirrors using different instruments will be presented. Several optical figure-testing techniques were used to overcome the vibration problem associated with optical testing with long optical path length.
Author

Cryogenics; Imaging Techniques; Optical Paths

NASA Marshall Space Flight Center, Huntsville, AL USA

Cryogenic Optical Systems and Instrumentation IX (AM 116) Newly Modified Cryogenic Optical Test Facility at the Marshall Space Flight Center

Eng, Ronnie, NASA Marshall Space Flight Center, USA; Kegley, Jeff, NASA Marshall Space Flight Center, USA; Keidel, John, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 8th; Infrared Spaceborne Remote Sensing, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Marshall Space Flight Center (MSFC) has maintained and operated a world-class x-ray optics and detector testing facility known as the X-ray Calibration Facility (XRCF) since the mid 1970's. The ground test and calibration of the Chandra X-ray Observatory optics and detectors were successfully completed at the XRCF in 1997. The beginning of the Next Generation Space Telescope (NGST) development programs (NMSD, SBMD, AMSD, etc.) and the establishment of the Space Optics Manufacturing Technology Center at MSFC have led to an XRCF modification. In 1999 the facility was upgraded to perform cryogenic testing of lightweight visible optics (without compromising the existing x-ray testing capability). A thermal enclosure capable of 20 degrees Kelvin and vibration isolated instrumentation mount were added. A vacuum-compatible five-axis motion table was modified to operate under cryogenic conditions. Optics up to two meters in diameter with radii of curvature of up to twenty meters can be accommodated. Facility characterization tests and one NGST program mirror test have been completed to date. by July 2000, two other mirrors will be tested. Optical wavefront measurements were made at is less than 35 degrees Kelvin with several instruments located at the test mirror's radius of curvature. The current wavefront measuring instruments include a Shack-Hartman wavefront sensor, a point diffraction interferometer, a point spread function-measuring device, and a radius of curvature measuring instrument. A vibration insensitive phase shifting interferometer is planned for future optical testing. This paper will present a brief history of the facility, a discussion of its current x-ray optic testing capabilities, and a complete description of the new capabilities in the visible optical testing regime.
Author

Cryogenics; Optical Measurement; Measuring Instruments

NASA Marshall Space Flight Center, Huntsville, AL USA

Further Investigations of the Passive Optical Sample Assembly (POSA) - I Flight Experiment

Finckenor, Miria M., NASA Marshall Space Flight Center, USA; Kamenetzky, Rachel R., NASA Marshall Space Flight Center, USA; Vaughn, Jason A., NASA Marshall Space Flight Center, USA; Mell, Richard, AZ Technology, USA; Deshpande, M. S., IIT Research Inst., USA; [2001]; 3p; In English; 39th; 39th Aerospace Sciences Meeting, 8-11 Jan. 2001, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 478-88-50; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Passive Optical Sample Assembly-I (POSA-I), part of the Mir Environmental Effects Payload (MEEP), was designed to study the combined effects of contamination, atomic oxygen, ultraviolet radiation, vacuum, then-nal cycling, and other constituents of the space environment on spacecraft materials. The MEEP program is a Phase I International Space Station Risk Mitigation Experiment. Candidate materials for the International Space Station (ISS) were exposed in a specially designed "suitcase" carrier, with identical specimens facing either Mir or space. The payload was attached by EVA to the exterior of the Mir docking module during the STS-76 mission (f'ig. 1). It was removed during the STS-86 mission after an 18-month exposure. During the mission, it received approximately 7 x 1019 atoMS/CM2 atomic oxygen, as calculated by polymer mass loss, and 413 ESH of solar ultraviolet radiation on the Mir-facing side. The side facing away from Mir received significant contaminant deposition, so atomic oxygen fluence has not been reliably determined. The side facing away from Mir received 571 ESH of solar UV. Contamination was observed on both the Mir-facing and space-facing sides of the POSA-I experiment , with a greater amount of deposition on the space facing side than the Mir side. The contamination has been determined to be outgassed silicone photofixed by ultraviolet

radiation and converted to silicate by atomic oxygen interaction. Electron spectroscopy for chemical analysis (ESCA) with depth profiling indicated the presence of 26 - 31 nm silicate on the Mir-facing side and 500 - 1000 nm silicate on the space-facing side. The depth profiling also showed that the contaminant layer was uniform, with a small amount of carbon present on the surface and trace amounts of nitrogen, phosphorus, sulfur, and tin. The surface carbon layer is likely due to post-flight exposure in the laboratory and is similar to carbonaceous deposits on control samples. EDAX and FTIR analysis concurred with ESCA for the presence of silicon, oxygen, and carbon. Nearly 400 samples were exposed on POSA-I, which included materials such as thermal control coatings polymeric films, optical materials, and multi-layer insulation blankets. A previous paper discussed the effects of the space environment exposure and contaminant deposition on candidate materials for ISS, including Z93P inorganic thermal control coating, various anodizes, and multi-layer insulation blankets. This paper details the investigation of environmental effects on the remainder of POSA-I samples, particularly the innovative conductive thermal control coatings developed by AZ Technology of Huntsville, AL and HT Research Institute of Chicago, IL. The silicone/silicate contamination had a significant impact on the solar absorptance of white inorganic thermal control coatings on the space-facing side of POSA-I. The effect of contamination on electrical conductivity is discussed. Samples of conductive anodized aluminum developed by Boundary Technologies of Buffalo Grove, IL were also exposed on POSA-I. The effects of the space environment and contaminant deposition on the optical and electrical properties of the conductive anodized aluminum are discussed.
Author

Contaminants; Contamination; Oxygen Atoms; Spacecraft Construction Materials; Spaceborne Experiments; Earth Orbital Environments

20000073228 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Recent Developments and Applications of Quantum Well Infrared Photodetector Focal Plane Arrays

Gunapala, S. D., Jet Propulsion Lab., California Inst. of Tech., USA; Bandara, S. V., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

There are many applications that require long wavelength, large, uniform, reproducible, low cost, stable, and radiation-hard infrared (IR) focal plane arrays (FPAs). For example, the absorption lines of many gas molecules, such as ozone, water, carbon monoxide, carbon dioxide, and nitrous oxide occur in the wavelength region from 3 to 18 micron. Thus, IR imaging systems that operate in the long wavelength IR (LWIR) region (6 - 18 micron) are required in many space borne applications such as monitoring the global atmospheric temperature profiles, relative humidity profiles, cloud characteristics, and the distribution of minor constituents in the atmosphere which are being planned for future NASA Earth and planetary remote sensing systems. Due to higher radiation hardness, lower 1/f noise, and larger array size the GaAs based Quantum Well Infrared Photodetector (QWIP) FPAs are very attractive for such space borne applications compared to intrinsic narrow band gap detector arrays. In this presentation we will discuss the optimization of the detector design, material growth and processing that has culminated in realization of large format long-wavelength QWIP FPAs, portable and miniature LWIR cameras, holding forth great promise for myriad applications in 6-18 micron wavelength range in science, medicine, defense and industry. In addition, we will present some system demonstrations using broadband, two-color, and high quantum efficiency long-wavelength QWIP FPAs.
Author

Focal Plane Devices; Infrared Imagery; Quantum Wells; Photometers; Quantum Efficiency; Infrared Radiation; Imaging Techniques

20000073245 NASA Goddard Space Flight Center, Greenbelt, MD USA

IRIS Mariner 9 Data Revisited, 1, An Instrumental Effect

Formisano, V., Consiglio Nazionale delle Ricerche, Italy; Grassi, D., Consiglio Nazionale delle Ricerche, Italy; Piccioni, G., Consiglio Nazionale delle Ricerche, Italy; Pearl, John, NASA Goddard Space Flight Center, USA; Bjoraker, G., NASA Goddard Space Flight Center, USA; Conrath, B., Cornell Univ., USA; Hanel, R.; [1999]; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Small spurious features are present in data from the Mariner 9 Infrared Interferometer Spectrometer (IRIS). These represent a low amplitude replication of the spectrum with a doubled wavenumber scale. This replication arises principally from an internal reflection of the interferogram at the input window. An algorithm is provided to correct for the effect, which is at the 2% level. We believe that the small error in the uncorrected spectra does not materially affect previous results; however, it may be significant for some future studies at short wavelengths. The IRIS spectra are also affected by a coding error in the original calibration that results in only positive radiances. This reduces the effectiveness of averaging spectra to improve the signal to noise ratio at small signal levels.
Author

Spectra; Infrared Interferometers; Calibrating; Algorithms; Data Acquisition; Errors

Development Towards a Space Qualified Laser Stabilization System in Support of Space-Based Optical Interferometers

Seidel, David J., Jet Propulsion Lab., California Inst. of Tech., USA; Dubovitsky, Serge, Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We report on the development, functional performance and space-qualification status of a laser stabilization system supporting a space-based metrology source used to measure changes in optical path lengths in space-based stellar interferometers. The Space Interferometry Mission (SIM) and Deep Space 3 (DS-3) are two missions currently funded by the National Aeronautics and Space Administration (NASA) that are space-based optical interferometers. In order to properly recombine the starlight received at each telescope of the interferometer it is necessary to perform high resolution laser metrology to stabilize the interferometer. A potentially significant error source in performing high resolution metrology length measurements is the potential for fluctuations in the laser gauge itself. If the laser frequency or wavelength is changing over time it will be misinterpreted as a length change in one of the legs of the interferometer. An analysis of the frequency stability requirement for SIM resulted in a fractional frequency stability requirement of square root $(S(sub\ y)(f))$ = is less than 2 x 10(exp -12)/square root(Hz) at Fourier frequencies between 10 Hz and 1000 Hz. The DS-3 mission stability requirement is further increased to square root $(S(sub\ y)(f))$ = is less than 5 x 10(exp -14)/Square root(Hz) at Fourier frequencies between 0.2 Hz and 10 kHz with a goal of extending the low frequency range to 0.05 Hz. The free running performance of the Lightwave Electronics NPRO lasers, which are the baseline laser for both SIM and DS-3 vary in stability and we have measured them to perform as follows (9 x l0(exp -11)/ f(Hz))(Hz)/square root(Hz)) = is less than (square root $(S(sub\ y)(f))$ = is less than (1.3 x l0(exp -8)/ f(Hz))/Square root(Hz). In order to improve the frequency stability of the laser we stabilize the laser to a high finesse optical cavity by locking the optical frequency of the laser to one of the transmission modes of the cavity. At JPL we have built a prototype space-qualifiable system meeting the stability requirements of SIM, which has been delivered to one of the SIM testbeds. We have also started on the development of a system to meet the stability needs of DS-3.
Author

Interferometry; Optical Measurement; Spaceborne Lasers; Stabilization; Laser Applications; Laser Stability

The Glast Burst Monitor

Meegan, Charles, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Marcel Grossman Meeting, 2 Jul. 2000, Rome, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

The Gamma-Ray Large Area Space Telescope (GLAST) will include a secondary instrument to augment the observatory's capabilities for GRB studies. The GLAST Burst Monitor (GBK is a collaboration between Marshall Space Flight Center, the University of Huntsville, Alabama, and the Max Plank Institute for Extraterrestrial Physics. The purpose of the GBM is to extend energy coverage below the main instrument's lower limit of about 20 MeV, and to provide an on-board burst trigger and approximate location. The instrument consists of twelve NaI detectors and two BGO detectors. This combination provides energy coverage from a few keV up to about 30 MeV.
Author

Gamma Ray Telescopes; Gamma Ray Bursts; Gamma Ray Astronomy; Monitors

Molecular Modeling and Experimental Study of Nonlinear Optical Compounds: Mono-Substituted Derivatives of Dicya-novinylbenzene

Timofeeva, Tatyana V., NASA Marshall Space Flight Center, USA; Nesterov, Vladimir N., NASA Marshall Space Flight Center, USA; Antipin, Mikhael Y., NASA Marshall Space Flight Center, USA; Clark, R. D., NASA Marshall Space Flight Center, USA; Sanghadasa, M., NASA Marshall Space Flight Center, USA; Cardelino, B. H., NASA Marshall Space Flight Center, USA; Moore, C. E., NASA Marshall Space Flight Center, USA; Frazier, Donald O., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A search for potential nonlinear optical (NLO) compounds has been performed using the Cambridge Structural Database and molecular modeling. We have studied a series of mono-substituted derivatives of dicyanovinylbenzene as the NLO properties of one of its derivatives (o-methoxy-dicyanovinylbenzene, DIVA) were described earlier. The molecular geometry in the series of the compounds studied was investigated with an X-ray analysis and discussed along with results of molecular mechanics and ab initio quantum chemical calculations. The influence of crystal packing on the molecular planarity has been revealed. Two new compounds from the series studied were found to be active for second harmonic generation (SHG) in the powder. The measurements of SHG efficiency have shown that the o-F- and p-CL-derivatives of dicyanovinylbenzene are about 10 and 20- times more active than urea, respectively. The peculiarities of crystal structure formation in the framework of balance between the van der

Waals and electrostatic interactions have been discussed. The crystal morphology of DIVA and two new SHG-active compounds have been calculated on the basis of their known crystal structures.
Author
Methoxy Systems; Nonlinearity; Optical Materials; Crystallization; Crystallography; Molecular Structure

20000074106 NASA Marshall Space Flight Center, Huntsville, AL USA
Replication of Low Density Electroformed Normal Incidence Optics
Ritter, Joseph M., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Diffractive Optics and Micro-Optics/Optical Fabrication and Testing Topical Meeting, 18-22 Jun. 2000, Quebec, Canada
Contract(s)/Grant(s): NAS8-40836; Proj. SVT96-45100; RTOP 451-102-00; No Copyright; Avail: Issuing Activity; Abstract Only

Replicated electroformed light-weight nickel alloy mirrors can have high strength, low areal density (is less than 3kg/m2), smooth finish, and controllable alloy composition. Progress at NASA MSFC SOMTC in developing normal incidence replicated Nickel mirrors will be reported.
Author
High Strength; Mirrors; Nickel Alloys; Optical Equipment

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.

20000068977 Sverdrup Technology, Inc., Arnold Engineering Development Center Group, Arnold AFS, TN USA
Laser-Induced Fluorescence Thermometry of a Weakly Ionized Radio-Frequency Plasma
Ruyten, Wim; Smith, Michael S.; Price, Linwood L.; Jan. 11, 1999; 11p; In English; Presented at 37th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV., 11-14 Jan 99.
Report No.(s): AD-A368296; AIAA-PAPER-99-0721; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Results are reported of two-line laser-induced fluorescence thermometry measurements in a weakly ionized, radiofrequency plasma. The work was performed in support of hypervelocity studies in the AEDC SI Impact Range. Rotational temperatures of nitric oxide were determined to be in the range 1000-2000 K, based on excitation of two lines in the NO A-X (0,0) band. A data analysis procedure is described for separating the weak, laser-induced fluorescence signals from natural emission from the plasma. by comparing temperatures from a strong and a weak beam, it is demonstrated that optical saturation is avoided. A strong correlation is found between the PLIF-derived NO temperatures and the intensity of natural emission from the plasma. This correlation is used to estimate the temperature distribution in the plasma outside the region that was accessible to interrogation by the laser sheets.
DTIC
Laser Induced Fluorescence; Plasmas (Physics); Temperature Measurement; Plasma Physics

20000070477 Florida Agricultural and Mechanical Univ., Dept. of Chemical Engineering, Tallahassee, FL USA
Pulsed Streamer Reactor Characterization, Phase 2 *Final Report, 1 Jan-15 May 1997*
Locke, Bruce R., Florida Agricultural and Mechanical Univ., USA; May 15, 1997; 123p; In English
Contract(s)/Grant(s): F08937-93-C-0020; AF Proj. 1900
Report No.(s): AD-A377770; AFRL-ML-TY-TR-2000-4522-PT2; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

Aqueous phase pulsed corona discharge is considered an alternative for wastewater treatment. This report presents an analysis of the physical and chemical aspects of corona discharge in water, in salt solutions, and in solutions containing added particles. The addition of activated carbon to liquid phase corona discharges leads to enhanced streamer production and higher sparkover voltages. Higher sparkover voltages and enhanced streamer production are expected to lead to enhanced production of reactive species that lead to pollutant degradation. A mathematical model describing bulk solution chemical reactions, chemical reactions in the particle phase, and diffusion into the particle phase, has been developed using the methods of spatial averaging. Measurement of phenol degradation and byproduct formation in the liquid phase corona reactor with and without added particles and at various applied voltages was performed. Experiments with corona in the presence of aqueous film-forming foam (AFFF) indicate that corona is able to mechanically disrupt the structure of the foam and that a corona discharge can be created in the presence

of a foam. Foamability measurements indicate however, that the pulsed corona may not significantly chemically degrade the AFFF.
DTIC
Electric Corona; Reactivity; Electric Pulses; Plasma Display Devices; Waste Water; Water Treatment

20000070480 Naval Research Lab., Radiation Hydrodynamics Branch, Washington, DC USA
Advanced Radiation Theory Support, Annual Report 1999 *Final Report*
May 22, 2000; 142p; In English
Report No.(s): AD-A377942; NRL/MR/6720--00-8433; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy
   This program describes the work of the Radiation Hydrodynamics Branch during FY 99 in support of the DTRA PRS program. Critical issues covered are: (1) Theory and modeling of enhanced energy dissipation in Z-pinch plasmas, (2) Experimentally and theoretically comparing uniform fill versus annular shell gas puff behavior of a series of Ar:Ne mixture experiments on Saturn, (3) Large initial radius Z-pinch load behavior on Saturn, Double Eagle, and Decade Quad pulsed power machines, (4) Novel approaches for producing 10 keV photons from long pulse machines, and (5) Kinetic energy and viscous dissipation in moderate atomic number plasmas.
DTIC
Hydrodynamics; Plasmas (Physics); Zeta Pinch; Energy Transfer

20000070669 Energia Nucleare e Delle Energie Alternative, Servizio Edizioni Scientifiche, Rome, Italy
Inertial confinement physics and technology group progress report (1994- 1995)
Caruso, A.; Strangio, C.; May 31, 1998; 36p; In English
Report No.(s): DE99-712664; ENEA-RT-ERG-FUS-96-18; No Copyright; Avail: Department of Energy Information Bridge
   The technical activities performed during the period 1994-1995 in the framework of the Inertial Fusion Physics and Technology Group, are reported. The theoretical and numerical work, as well as experiments performed with the Frascati ABC facility are described.
NTIS
Inertial Confinement Fusion; Plasma Diagnostics; Research

20000070670 Energia Nucleare e Delle Energie Alternative, Centro Ricerche Frascati, Rome, Italy
Inertial confinement physics and technology group progress report (1996)
Associazione, F. R. I.; May 31, 1998; 23p; In English
Report No.(s): DE99-712663; ENEA-RT-ERG-FUS-97-03; No Copyright; Avail: Department of Energy Information Bridge
   In this report the technical activities of the Inertial Confinement Fusion (ICF) Physics and Technology Group are described. Experiments with the Frascati ABC facility, ICF-relevant theoretical studies and numerical simulations, as well as technological development on target fabrication and on rising topics related to laser ICF drivers are discussed.
NTIS
Inertial Confinement Fusion; Plasma Diagnostics; Research

20000070681 NASA Marshall Space Flight Center, Huntsville, AL USA
Specifications of a Plasmasphere Modeling Code for GGCM
Gallagher, D. L., NASA Marshall Space Flight Center, USA; Ober, D., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Geospace Environment Modeling, 19-23 Jun. 2000, Aspen, CO, USA; No Copyright; Avail: Issuing Activity; Abstract Only
   The Dynamic Global Core Plasma Model (DGCPM) is a parameterized model for core or thermal plasma in the magnetosphere. The model accounts for dayside ionospheric outflow and nightside inflow. It accounts for the global pattern of convection and corotation. The model is capable of being coupled to ring current and superthermal electron models for the purpose of providing thermal plasma spatial distributions and for the purpose of accepting the dynamic influences of these plasma populations back upon the thermal plasma. The DGCPM is designed to operate alone or to operate as part of a larger integrated package. The convection electric field and magnetic field used within the DGCPM can be shared with models of other plasma populations, in addition to the exchange of parameters important to the collective modeling of whole plasma systems in the inner magnetosphere. This talk will present the features of the DGCPM model code and the various forms of information that can be exchanged with other cooperating codes.
Author
Plasmasphere; Applications Programs (Computers); Thermal Plasmas; Dynamic Models

20000073715 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Ionization Properties of Molecules Commonly Used for Plasma Processing of Semi-Conductors
Srivastava, S. K., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Two types of processes are involved in plasma processing of semi-conductors. They are: plasma etching or cleaning and plasma deposition of the semi-conducting materials. For plasma etching of semi-conductors mostly halogen containing gases are used as additives to gases such as O2 and N2. For plasma deposition gases such as C2H2, SiH4, Si2H6 have been tested in the past. For an optimal performance of a reactor it is important to model the plasma. In this modeling effort electron impact excitation and ionization cross sections play a central role. For ionization balance calculations values of ionization cross sections are needed. Ion molecule reactions determine the ultimate composition of the plasma. Recently it has been discovered that the by products of many of these plasmas are per fluro hydrocarbons (PFCs) which are highly infrared absorbing species and have long life times in the atmosphere. They cause global warming. A lot of research is being pursued at the present time to find alternative molecules which do not produce global warming gases as the and product of the plasma processing reactor. There is also interest in the ionization and dissociative ionization properties of these molecules from the point view of the plasma abatement of the pollutant gases at the exhaust of the semi-conductor processing reactors. At the conference ionization and dissociative ionization properties of some of these molecules will be presented.
Author
Ionization; Dissociation; Excitation; Electron Impact; Plasma Conductivity; Plasma Etching; Plasmas (Physics); Deposition; Semiconductors (Materials)

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SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

20000068481 NASA Ames Research Center, Moffett Field, CA USA
Formation and Migration Energies of Interstitials in Silicon Under Strain Conditions
Halicioglu, Timur, NASA Ames Research Center, USA; Barnett, David M., Stanford Univ., USA; [1999]; 16p; In English
Contract(s)/Grant(s): NAS2-14031; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Simulation calculations are conducted for Si substrates to analyze formation and diffusion energies of interstitials under strain condition using statics methods .based on a Stillinger-Weber type potential function. Defects in the vicinity of the surface region and in the bulk are examined, and the role played by compressive and tensile strains on the energetics of interstitials is investigated. Results indicate that strain alters defect energetics which, in turn, modifies their diffusion characteristics.
Author
Simulation; Computation; Silicon; Substrates; Diffusion; Energy of Formation

20000068924 NASA Marshall Space Flight Center, Huntsville, AL USA
Reduction of Defects in Germanium-Silicon
Szofran, F. R., NASA Marshall Space Flight Center, USA; Benz, K. W., Freiburg Univ., Germany; Cobb, S. D., NASA Marshall Space Flight Center, USA; Croell, A., Alabama Univ., USA; Dold, P., Freiburg Univ., Germany; Kaiser, N., Freiburg Univ., Germany; Motakel, S., Illinois Univ. at Urbana-Champaign, USA; Walker, J. S., Illinois Univ. at Urbana-Champaign, USA; [2000]; 2p; In English; Microgravity Materials Science, Unknown; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Crystals grown without contact with a container have far superior quality to otherwise similar crystals grown in direct contact with a container. In addition to float-zone processing, detached-Bridgman growth is a promising tool to improve crystal quality, without the limitations of float zoning. Detached growth has been found to occur frequently during microg experiments and considerable improvements of crystal quality have been reported for those cases. However, no thorough understanding of the process or quantitative assessment of the quality improvements exists so far. This project is determining the means to reproducibly grow Ge-Si alloys in the detached mode.
Derived from text
Defects; Germanium; Silicon

20000070800 NASA Marshall Space Flight Center, Huntsville, AL USA

Synchrotron X-Ray Reciprocal Space Mapping, Topography and Diffraction Resolution Studies of Macromolecular Crystal Quality

Boggon, T. J., NASA Marshall Space Flight Center, USA; Helliwell, J. R., NASA Marshall Space Flight Center, USA; Judge, Russell A., NASA Marshall Space Flight Center, USA; Siddons, D. P., NASA Marshall Space Flight Center, USA; Snell, Edward H., NASA Marshall Space Flight Center, USA; Stojanoff, V., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A comprehensive study of microgravity and ground grown chicken egg white lysozyme crystals is presented using synchrotron X-ray reciprocal space mapping, topography techniques and diffraction resolution. Microgravity crystals displayed, on average, reduced intrinsic mosaicities but no differences in terms of stress over their earth grown counterparts. Topographic analysis revealed that in the microgravity case the majority of the crystal was contributing to the peak of the reflection at the appropriate Bragg angle. In the earth case at the diffraction peak only a small volume of the crystal contributed to the intensity. The techniques prove to be highly complementary with the reciprocal space mapping providing a quantitative measure of the crystal mosaicity and stress (or variation in lattice spacing) and topography providing a qualitative overall assessment of the crystal in terms of its X-ray diffraction properties. Structural data collection was also carried out both at the synchrotron and in the laboratory.
Author

Crystals; Diffraction; Synchrotrons; Topography; X Ray Diffraction; Macromolecules; Mapping

20000070859 California Inst. of Tech., Materials and Process Simulation Center, Pasadena, CA USA

Atomistic Design and Simulations of Nanoscale Machines and Assembly *Final Report, 1 Apr. 1997 - 31 Mar. 2000*

Goddard, William A., III, California Inst. of Tech., USA; Cagin, Tahir, California Inst. of Tech., USA; Walch, Stephen P., Eloret Corp., USA; Jun. 27, 2000; 5p; In English

Over the three years of this project, we made significant progress on critical theoretical and computational issues in nanoscale science and technology, particularly in:(1) Fullerenes and nanotubes, (2) Characterization of surfaces of diamond and silicon for NEMS applications, (3) Nanoscale machine and assemblies, (4) Organic nanostructures and dendrimers, (5) Nanoscale confinement and nanotribology, (6) Dynamic response of nanoscale structures nanowires (metals, tubes, fullerenes), (7) Thermal transport in nanostructures.
Derived from text

Nanostructures (Devices); Nanotechnology; Nanotubes; Simulation

20000070862 Universities Space Research Association, Huntsville, AL USA

Protein Crystal Growth Dynamics and Impurity Incorporation

Chernov, Alex A., Universities Space Research Association, USA; Thomas, Bill, Universities Space Research Association, USA; [2000]; 1p; In English, 26 Aug. 2000, Nancy, France; Sponsored by Paris VI Univ., France

The general concepts and theories of crystal growth are proven to work for biomolecular crystallization. This allowed us to extract basic parameters controlling growth kinetics - free surface energy, alpha, and kinetic coefficient, beta, for steps. Surface energy per molecular site in thermal units, $alpha(omega)^{2/3}/kT$ approx. = 1, is close to the one for inorganic crystals in solution (omega is the specific molecular volume, T is the temperature). Entropic restrictions on incorporation of biomolecules into the lattice reduce the incorporation rate, beta, by a factor of 10^2 - 10^3 relative to inorganic crystals. A dehydration barrier of approx. 18kcal/mol may explain approx. 10^{-6} times difference between frequencies of adding a molecule to the lattice and Brownian attempts to do so. The latter was obtained from AFM measurements of step and kink growth rates on orthorhombic lysozyme. Protein and many inorganic crystals typically do not belong to the Kossel type, thus requiring a theory to account for inequivalent molecular positions within its unit cell. Orthorhombic lysozyme will serve as an example of how to develop such a theory. Factors deteriorating crystal quality - stress and strain, mosaicity, molecular disorder - will be reviewed with emphasis on impurities. Dimers in ferritin and lysozyme and acetylated lysozyme, are microheterogeneous i.e. nearly isomorphic impurities that are shown to be preferentially trapped by tetragonal lysozyme and ferritin crystals, respectively. The distribution coefficient, K defined as a ratio of the (impurity/protein) ratios in crystal and in solution is a measure of trapping. For acetylated lysoyzme, K = 2.15 or, 3.42 for differently acetylated forms, is independent of both the impurity and the crystallizing protein concentration. The reason is that impurity flux to the surface is constant while the growth rate rises with supersaturation. About 3 times lower dimer concentration in space grown ferritin and lysozyme crystals might be examples explaining higher

quality of the space grown protein crystal. Depletion of solution with respect to isomorphic impurities around a growing crystal may be K times deeper than with respect to the crystallizing protein.

Author

Protein Crystal Growth; Impurities; Biochemistry; Surface Energy; Deterioration; Dehydration; Crystallization

20000070866 NASA Marshall Space Flight Center, Huntsville, AL USA

The Question of Impurities in Macromolecule Crystal Quality Improvement in Microgravity

Judge, Russell A., NASA Marshall Space Flight Center, USA; Snell, Edward H., NASA Marshall Space Flight Center, USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; Sportiello, Michael G., Colorado Univ., USA; Todd, Paul, Colorado Univ., USA; Bellamy, Henry, Stanford Univ., USA; Borgstahl, Gloria E., Toledo Univ., USA; Pokros, Matthew, Toledo Univ., USA; Cassanto, John M., Instrumentation Technology Associates, Inc., USA; [2000]; 1p; In English; Spacebound, 15 May 2000, Vancouver, Canada; No Copyright; Avail: Issuing Activity; Abstract Only

While macromolecule impurities may affect crystal size and morphology the over-riding question is how do macromolecule impurities effect crystal X-ray quality and diffraction resolution. In the case of chicken egg white lysozyme previous researchers have reported that crystals grown in the presence of ovalbumin, ovotransferrin, and turkey egg white lysozyme show no difference in diffraction resolution compared to those grown in pure solutions. One impurity however, a naturally occurring lysozyme dimer, does negatively impact the X-ray crystal properties. For this impurity it has been reported that crystal quality improvement in microgravity may be due to improved impurity partitioning during crystallization. In this study we have examined the incorporation of the dimer into lysozyme crystals, both on the ground and in microgravity experiments, and have performed detailed X-ray analysis of the crystals using a new technique for finely probing the mosaicity of the crystal at the Stanford Synchrotron Radiation Laboratory. Dimer partitioning was not significantly different in microgravity compared to the ground based experiments, although it is significantly better than that previously reported in microgravity. Mosaicity analysis of pure crystals, 1422 indexed reflections (microgravity) and 752 indexed reflections (ground), gave average results of 0.0066 and 0.0092 degrees (FWHM) respectively. The microgravity crystals also provided an increased signal to noise. Dimer incorporation increased the average mosaicity in microgravity but not on the ground. However, dimer incorporation did greatly reduce the resolution limit in both ground and microgravity grown crystals. The data is being treated anisotropically to explore these effects. These results indicate that impurity effects in microgravity are complex and that the conditions or techniques employed may greatly affect the role of impurities.

Author

Impurities; Microgravity; Crystal Growth; Quality Control; Morphology; Macromolecules; Gravitational Effects

20000070869 NASA Marshall Space Flight Center, Huntsville, AL USA

A Compact X-Ray System for Macromolecular Crystallography, 5

Gubarev, Mikhail, National Academy of Sciences - National Research Council, USA; Ciszak, Ewa, Universities Space Research Association, USA; Ponomarev, Igor, X-Ray Optical Systems, Inc., USA; Joy, Marshall, NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We describe the design and performance of a high flux x-ray system for macromolecular crystallography that combines a microfocus x-ray generator (40 gm FWHM spot size at a power level of 46.5Watts) and a 5.5 mm focal distance polycapillary optic. The Cu K(sub alpha) X-ray flux produced by this optimized system is 7.0 times above the X-ray flux previously reported. The X-ray flux from the microfocus system is also 3.2 times higher than that produced by the rotating anode generator equipped with a long focal distance graded multilayer monochromator (Green optic; CMF24-48-Cu6) and 30% less than that produced by the rotating anode generator with the newest design of graded multilayer monochromator (Blue optic; CMF12-38-Cu6). Both rotating anode generators operate at a power level of 5000 Watts, dissipating more than 100 times the power of our microfocus x-ray system. Diffraction data collected from small test crystals are of high quality. For example, 42,540 reflections collected at ambient temperature from a lysozyme crystal yielded R(sub sym) 5.0% for the data extending to 1.7A, and 4.8% for the complete set of data to 1.85A. The amplitudes of the reflections were used to calculate difference electron density maps that revealed positions of structurally important ions and water molecules in the crystal of lysozyme using the phases calculated from the protein model.

Author

X Rays; Monochromators; Crystallography; Design Analysis; Performance Prediction

20000070871 NASA Marshall Space Flight Center, Huntsville, AL USA

Gravity-Related Transport Process in Off-Axis Sputtering Deposition

Zhu, Shen, Universities Space Research Association, USA; Su, Ching–Hua, NASA Marshall Space Flight Center, USA; Leho-

zeku, S. L., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 12th; Crystal Growth and Epitaxy, 13-18 Aug. 2000, Vail, CO, USA

In the synthesis of epitaxial oxide films, reactive off-axis sputtering deposition techniques have demonstrated the advantages of fabricating high quality epitaxial films. Due to the collisions between the sputtered species and the residue gases, the kinetic energy of species was reduced and the transport of depositing species changed from a ballistic movement to a diffusive drift in which the transport species were almost thermalized. A gravity effect could appear in the transport process. Three transport regimes were observed when the growth pressures vary from 5 mTorr to 150 mTorr. Film growth rate, depositing orientations, crystal structure, surface morphology, and compositions were characterized. A gravity related phenomenon was revealed in film growth at the relative low growth pressures.

Author

Deposition; Epitaxy; Oxide Films; Magnetron Sputtering

20000070872 NASA Marshall Space Flight Center, Huntsville, AL USA

The High Mosaicity Illusion: Revealing the True Physical Characteristics of Macromolecular Crystals

Bellamy, Henry, NASA Marshall Space Flight Center, USA; Snell, Edward H., NASA Marshall Space Flight Center, USA; Borgstahl, Gloria, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

An experimental system and software have been developed for simultaneously measuring the diffraction resolution and mosaic spread of macromolecular crystals. Hundreds of reflection profiles over a wide resolution range were rapidly measured by using a charge coupled device (CCD) area detector in combination with superfine phi slicing data collection. The contributions of the X-ray beam to the reflection widths were minimized by using a highly-parallel, highly-monochromatic synchrotron source. These contributions and Lorentz effects were evaluated and deconvoluted from the recorded data. Data collection and processing is described. From one degree of superfine phi slice data collected on a crystal of manganese superoxide dismutase the mosaicity of 261 reflections were measured. The average mosaicity was 0.0101 degrees (0.0035) at the full-width-at-half-maximum (FWHM) and ranged from 0.0011 degrees to 0.0188 degrees. Each reflection profile was individually fit with two gaussian profiles with the first gaussian contributing 55% and the second contributing 35% of the reflection. On average, the mosaicity of the first gaussian was 0.0054 degrees (0.0015) and the second was 0.0061 degrees (0.0023). The mosaicity of the crystal was anisotropic with fh, f k, and fl values of 0.0068 degrees, 0.0140 degrees and 0.0046 degrees, respectively at the FWHM. The anisotropic mosaicity analysis indicates that the crystal is the most perfect in the I direction which corresponds to the favored growth direction of the crystal.

Author

Crystals; Mosaics; Macromolecules; Diffraction; Physical Properties

20000073220 Universities Space Research Association, Huntsville, AL USA

Effect of Melt Convection at Various Gravity Levels and Orientations on the Forces Acting on a Large Spherical Particle in the Vicinity of a Solidification Interface

Bune, Andris V., Universities Space Research Association, USA; Sen, Subhayu, Universities Space Research Association, USA; Mukherjee, Sundeep, Alabama Univ., USA; Catalina, Adrian, Universities Space Research Association, USA; Stefanescu, Doru M., Alabama Univ., USA; Journal of Crystal Growth; 2000; ISSN 0022-0248; Volume 211, pp. 446-451; In English

Numerical modeling was Undertaken to analyze the influence of both radial and axial thermal gradients on convection patterns and velocities claiming solidification of pure Al and an Al-4 wt% Cu alloy. The objective of the numerical task was to predict the influence of convective velocity on an insoluble particle near a solid/liquid (s/l) interface. These predictions were then be used to define the minimum gravity level (q) required to investigate the fundamental physics of interactions between a particle and a s/l interface. This is an ongoing NASA founded flight experiment entitled "particle engulfment and pushing by solidifying interfaces (PEP)". Steady-state calculations were performed for different gravity levels and orientations with respect to the gravity vector The furnace configuration used in this analysis is the quench module insert (QMI-1) proposed for the Material Science Research Facility (MSRF) on board the International Space Station (ISS). The general model of binary alloy solidification was based on the finite element code FIDAP. At a low g level of 10(exp -4) g(sub o) (g(sub o) = 9.8 m/square s) maximum melt convection was obtained for an orientation of 90 deg. Calculations showed that even for this worst case orientation the dominant forces acting on the particle are the fundamental drag and interfacial forces.

Author

Binary Alloys; Finite Element Method; Liquid-Solid Interfaces; Mathematical Models; Melts (Crystal Growth); Crystal Growth; Gravitational Effects; Microgravity

20000073391 NASA Marshall Space Flight Center, Huntsville, AL USA

Optical Characterization of Bulk ZnSeTe Solid Solutions

Su, Ching–Hua, NASA Marshall Space Flight Center, USA; Feth, S., Alabama Univ., USA; Zhu, Shen, Universities Space Research Association, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Wang, Ling Jun, Tennessee Univ., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Optical characterization was performed on wafers sliced from crystals of ZnSe, ZnTe and ZnSe (sub 1-x) Te (sub x) (0 less than x less than 0.4) grown by physical vapor transport technique. The energy band gaps at room temperature were determined from optical transmission measurements on 11 wafers. The best fit to the band gap vs. composition, x, data gives a bowing parameter of 1.336 which is between the value of 1.23 determined previously on ZnSeTe bulk crystals by reflectivity and the value of 1.621 reported on epilayers by photoconductivity. Low-temperature photoluminescence (PL) spectra were measured on 6 samples. The spectra of ZnSe and ZnTe were dominated by near band edge emissions and no deep donor-acceptor pairs were observed. The PL spectrum exhibited a broad emission for each of the ZnSe (sub 1-x) Te (sub x) samples, 0.09 less than x less than 0.39. For x = 0.09, this emission energy is about 0.2eV lower than the band gap energy measured at low temperature. As x increases the energy discrepancy gradually decreases and reduces to almost zero at x = 0.4. The single broad PL emission spectra and the spectra measured as a function of temperature were interpreted to be associated with the exciton bound to Te clusters because of the high Te content in these samples.
Author

Solid Solutions; Zinc Tellurides; Selenium; Optical Properties

20000074071 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Rotational Spectra of IO X(sub 1) (sup 2)pi(sub 3/2), v is less than or equal to 13 and X(sub 2) (sup 2)pi(sub 1/2), v is less than or equal to 9

Miller, Charles E., Haverford Coll., USA; Cohen, Edward A., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The rotational spectra of IO in vibrational states up to v = 13 in the X(sub 1) (sup 2)pi(sub 3/2) state and up to v = 9 in the X2 (sup 2)pi(sub 1/2) state have been observed in an O2 discharge over molecular I2. In addition, I(18)O has been observed for both the X(sub 1) and X(sub 2) states up to v = 5. All data have been analyzed simultaneously with fixed isotopic ratios among the constants. This extends the data set for the X(sub 1) state described last year at this meeting and provides the first high resolution data for the X(sub 2) state and for I(18)O. An extensive set of parameters has been derived. These will be interpreted in terms of the electronic structure and the interatomic potential.
Author

Rotational Spectra; Molecular Excitation; Vibrational Spectra; Vibrational States; Iodine Compounds; Oxides

20000074072 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The Rotational Spectrum of Iodine Dioxide, OIO

Miller, Charles E., Haverford Coll., USA; Cohen, Edward A., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The rotational spectra of OIO in its ground vibrational and first excited bending states have been observed for the first time. OIO was formed initially from the products of a microwave discharge in O2 passing over molecular iodine and later with greater yield in a DC discharge through a mixture of O2 and I2 vapor. OIO is an asymmetric prolate rotor (kappa = -0.690) with a (sup 2)B(sub 1) electronic ground state. Over 550 ground state transitions and over 160 transitions of the excited bending state have been included in the fits. The resulting parameters are well determined and will be compared to those recently published for OBrO and OClO. These will be interpreted in terms of the molecular geometry, harmonic force field, and electronic structure.
Author

Rotational Spectra; Molecular Excitation; Rotational States; Vibrational Spectra; Iodine; Oxygen

20000074074 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Measurement of the Heat Capacity of He-II Under a Heat Current Near the Lambda Transition

Harter, Alexa W., California Inst. of Tech., USA; Lee, Richard A. M., Jet Propulsion Lab., California Inst. of Tech., USA; Chui, Talso C. P., Jet Propulsion Lab., California Inst. of Tech., USA; Goodstein, David L., California Inst. of Tech., USA; [2000]; 1p; In English; STAIF-2000, 2000, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present preliminary measurements of the heat capacity of superfluid helium-4 under an applied heat current near the lambda transition. The calorimeter is a standard cylindrical thermal conductivity cell with a 0.6 mm gap between two copper endplates. The sidewall is made of stainless steel. A heat current density in the range of 1 to 4 microW/sq cm is applied through

the helium sample while a pulse method is used to measure the heat capacity. Temperature changes are recorded with high-resolution thermometers (HRTs) located on the top and bottom endplates. Corrections are made to the readings of the HRTs to account for the Kapitza boundary resistance and the anomalous Kapitza boundary resistance. After the corrections, both the top and the bottom HRTs. give the same heat capacity values. The heat capacity is found to be much larger than the prediction of recent theories. We also plotted our data on a scaled plot to test the prediction of scaling by the theories. The result and its interpretation will be presented. The cell height was deliberately made to be thin to reduce the effects of gravity. Nonetheless, gravity is expected to have significant effects on the heat capacity data in the temperature range of our measurement. A space experiment would remove this unwanted gravity effect and allow the true physics to be examined. Moreover, in the absence of gravity, a deeper cell can be used allowing HRTs to be mounted on to the sidewall providing direct measurements of the helium temperature, unaffected by the anomalous Kapitza boundary resistance.

Author

Heat Measurement; Calorimeters; Specific Heat; Thermal Conductivity; Temperature Measurement; Thermometers; Kapitza Resistance

20000074085 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Non-Equilibrium Superconductivity and Magnetic Pair Breaking in Perovskite Half-Metallic Ferromagnet-Insulator-Superconductor (F-I-S) Heterostructures

Fu, C.–C., California Inst. of Tech., USA; Yeh, N.–C., California Inst. of Tech., USA; Samoilov, A. V., California Inst. of Tech., USA; Vakili, K., California Inst. of Tech., USA; Li, Y., California Inst. of Tech., USA; Vasquez, R. P., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English, 20-26 Mar. 1999, Atlanta, GA, USA; Sponsored by American Physical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The effect of spin-polarized quasiparticle currents on the critical current density (J-c) of cuprate superconductors is studied in perovskite F-I-S heterostructures as a function of insulator thickness and of underlying magnetic materials. A pulsed current technique is employed to minimize extraneous Joule heating on the superconductor. At temperatures near T-c, F-I-S samples with insulator thicknesses\1e2nm show precipitous decrease in J_c as current injection (I_m) is increased. In contrast, J_c in a controlled sample with a substituted non-magnetic material (N-I-S) exhibit no dependence on I_m. Similarly, a F-I-S sample with a 10 mn insulating barrier also show little J_c effect versus I_m. At low temperatures with $I_m = 0$, significant suppression of J-c is observed only in the thin barrier F-I-S samples, although T_c and the normal-state resistivity of all samples are comparable. These phenomena can be attributed to the Cooper pair breaking induced by externally-injected and internally-reflected spin-polarized quasiparticle currents. We estimate an order of magnitude range for the spin diffusion length of 100 nm to 100\ mum.

Author

Superconductivity; Nonequilibrium Conditions; Magnetic Materials; Perovskites; Ferromagnetic Materials; Insulators; Current Density

20000074086 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Vortex-State Complex Hall Conductivity of Superconducting YBa2Cu3O7 Epitaxial Films at Radio Frequencies

Beam, D. A., California Inst. of Tech., USA; Yeh, N.–C., California Inst. of Tech., USA; Vasquez, R. P., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English, 20-26 Mar. 1999, Atlanta, GA, USA; Sponsored by American Physical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The first intermediate-frequency measurements of the vortex-state complex Hall conductivity σ_{xy} of $YBa_2CU_3O_7$ superconducting epitaxial films are reported. A direct transport measurement technique from dc to 7 MHz was used. The results are analyzed in terms of a phenomenological model, generalized from that for the dc Hall conductivity, with the assumptions that: 1) the sign reversal in the vortex-state Hall conductivity is associated with the different carrier densities within and far away from the vortex cores; 2) the Drude approximation Is applicable; and 3) the anomalous sign reversal occurs in the flux-flow Limit. The temperature, frequency, and magnetic field (B) dependencies of our σ_{xy} data are in good agreement with the model. The B-dependence of σ_{xy} reveals that both vortices ($\sigma_{xy}Av \propto BA-1$) and quasiparticles (sigma_xyAq $\propto B$) contribute to the vortex-state Hall conduction. The magnitude of the real part of σ_{xy}, $\sigma_{xy}A\prime$, is in good agreement with our model, while that of the imaginary part, $\sigma_{xy}A\prime \prime$, is significantly Luger than the theoretical prediction. This may be attributed to the unconventional electronic structures in the vortex core of cuprate superconductors with d-wave or mixed pairing symmetries.

Author

Hall Effect; Conductivity; Superconductors (Materials); YBCO Superconductors; Epitaxy; Superconducting Films; Radio Frequencies; Vortices

20000074098 Universities Space Research Association, Huntsville, AL USA

Phase Shift Interferometer and Growth Set Up to Step Pattern Formation During Growth From Solutions. Influence of the Oscillatory solution Flow on Stability

Chernov, Alex A., Universities Space Research Association, USA; Booth, N. A., Universities Space Research Association, USA; Vekilov, P. G., Alabama Univ., USA; Murray, B. T., State Univ. of New York, USA; McFadden, G. B., National Inst. of Standards and Technology, USA; [2000]; 1p; In English; Microgravity Materials Science Conference, 7 Jun. 2000, Huntsville, AL, USA; Sponsored by NASA Marshall Space Flight Center, USA

Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

We have assembled an experimental setup based on Michelson interferometry with the growing crystal surface as one of the reflective surfaces. The crystallization part of the device allows optical monitoring of a face of a crystal growing at temperature stable within 0.05 C in a flow of solution of controlled direction and speed. The reference arm of the interferometer contains a liquid crystal element that allows controlled shifts of the phase of the interferograms. We employ an image-processing algorithm, which combines five images with a pi/2 phase difference between each pair of images. The images are transferred to a computer by a camera capable of capturing 60 frames per second. The device allows data collection on surface morphology and kinetics during the face layers growth over a relatively large area (approximately 4 sq. mm) in situ and in real time during growth. The estimated depth resolution of the phase shifting interferometry is approximately 50 Angstroms. The data will be analyzed in order to reveal and monitor step bunching during the growth process. The crystal chosen as a model for study in this work is KH_2PO_4 (KDP). This optically non-linear material is widely used in frequency doubling applications. There have been a number of studies of the kinetics of KDP crystallization that can serve as a benchmark for our investigations. However, so far, systematic quantitative characteristics of step interaction and bunching are missing. We intend to present our first quantitative results on the onset, initial stages and development of instabilities in moving step trains on vicinal crystal surfaces at varying supersaturation, flow rate, and flow direction. Behavior of a vicinal face growing from solution flowing normal to the steps and periodically changing its direction in time was considered theoretically. It was found that this oscillating flow reduces both stabilization and destabilization effects resulted from the unidirectional solution flow directed up the step stream and down the step stream. This reduction of stabilization and destabilization comes from effective mixing which entangles the phase shifts between the spatially periodic interface perturbation and the concentration wave induced by this perturbation. Numerical results and simplified mixing criterion will be discussed.
Author

Crystal Growth; Oscillating Flow; Phase Shift; Solid Solutions; Stability; Michelson Interferometers; Crystal Surfaces

20000074113 NASA Marshall Space Flight Center, Huntsville, AL USA

Control of Convection by Dynamic Magnetic Fields for VB, FZ and THM Crystal Growth Application

Mazuruk, Konstantin, NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; FSRC Crystal Growth and Epitaxy 2000, 3-5 Apr. 2000, LaJolla, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The Traveling Magnetic Field (TMF) technique, recently proposed to control meridional flow in electrically conducting melts is reviewed. In particular, the natural convection damping capability of this technique has been numerically demonstrated with the implication of significantly improving crystal quality. Advantages of the traveling magnetic field, in comparison to the more mature rotating magnetic field method, are discussed. Finally, a detailed one-dimensional planar TMF model has been developed and is presented.
Author

Magnetic Fields; Free Convection; Crystal Growth; Mathematical Models; Meridional Flow

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PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also 72 Atomic and Molecular Physics, 73 Nuclear Physics, and 25 Inorganic, Organic and Physical Chemistry.

20000072570 Abdus Salam International Centre for Theoretical Physics, Trieste, Italy

Density profiles and collective excitations of a trapped two-component Fermi vapour

Amoruso, M.; Meccoli, I.; Minguzzi, A.; Tosi, M. P.; Aug. 31, 1999; 24p; In English

Report No.(s): DE99-636781; IC-99/102; No Copyright; Avail: Department of Energy Information Bridge

We discuss the ground state and the small-amplitude excitations of a degenerate vapor of fermionic atoms placed in two hyperfine states inside a spherical harmonic trap. An equations-of-motion approach is set up to discuss the hydrodynamic dissipation

processes from the interactions between the two components of the fluid beyond mean-field theory and to emphasize analogies with spin dynamics and spin diffusion in a homogeneous Fermi liquid. The conditions for the establishment of a collisional regime via scattering against cold-atom impurities are analyzed. The equilibrium density profiles are then calculated for a two-component vapor of K-40 atoms: they are little modified by the interactions for presently relevant values of the system parameters, but spatial separation of the two components will spontaneously arise as the number of atoms in the trap is increased. The eigenmodes of collective oscillation in both the total particle number density and the concentration density are evaluated analytically in the special case of a symmetric two-component vapor in the collisional regime. The dispersion relation of the surface modes for the total particle density reduces in this case to that of a one-component Fermi vapor, whereas the frequencies of all other modes are shifted by the interactions.
NTIS
Vapors; Fermi Liquids; Equations of Motion; Random Variables; Wave Dispersion; Particle Density (Concentration)

20000073796 Istituto Nazionale di Fisica Nucleare, Frascati, Italy
P(sub T) spectrum in heavy-flavour hadroproduction
Cacciari, M.; Greco, M.; Nason, P.; Mar. 31, 1998; 35p; In English
Report No.(s): DE99-722890; LNF-P-98-008; No Copyright; Avail: Department of Energy Information Bridge
    The Authors consider the transverse-momentum distribution of heavy flavours in hadronic collisions. The authors present a formalism in which large transverse-momentum logarithms are summed at the next-to-leading level, and mass effects are included exactly up to order (alpha)(sub S)(sup 3), so as to retain productivity at both small and large transverse momenta. As an example, the Authors apply our formalism to b production at the Tevatron.
NTIS
Productivity; Hadrons

20000073798 Istituto Nazionale di Fisica Nucleare, Lab. Nazionali di Frascati, Frascati, Italy
Searching for K(sub L)(yields)(pi)(sup 0)(nu)(nu) at a (Phi)-factory
Bossi, F.; Colangelo, G.; Isidori, G.; Feb. 28, 1998; 22p; In English
Report No.(s): DE99-722885; LNF-P-98-004; No Copyright; Avail: Department of Energy Information Bridge
    The perspectives of a search for the rare decay K(sub L)(yields)(pi)(sup 0) (nu)(nu) at a (Phi)-factory are discussed. After a general analysis, the authors focus on the realistic case of KLOE and DA(Phi)NE, showing that limits of the order of 10(sup -9) on BR(K(sub L)(yields)(pi)(sup 0)(nu)(nu)) are achievable in the next few years. The authors also discuss the theoretical implications of this kind of measurements.
NTIS
Industrial Plants; Particle Decay

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula.

20000070764 National Science Foundation, Washington, DC USA
Models of Excellence
1990; 90p; In English
Report No.(s): PB2000-106076; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy
    No program was in place for assisting underrepresented minority investigators at all colleges and universities. In response to the need, the Minority Research Initiation (MRI) program was established in fiscal year 1981. The MRI awards are one-time grants for underrepresented minority investigators who have not previously received Federal research support as faculty members. The term 'minority' refers to those ethnic groups that are significantly underrepresented at advanced levels of science and engineering. The booklet highlights 105 minority investigators who graduated from the nation's top research universities.
NTIS
Minorities; Research

Includes management planning and research.

20000068434 NASA Marshall Space Flight Center, Huntsville, AL USA

The Faster, Better, Cheaper Approach to Space Missions: An Engineering Management Assessment

Hamaker, Joe, NASA Marshall Space Flight Center, USA; [2000]; 22p; In English; Space Systems Cost Analysis Group Annual Conference, 11-12 May 2000, Noordwijk, Netherlands; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes, in viewgraph form, the faster, better, cheaper approach to space missions. The topics include: 1) What drives "Faster, Better, Cheaper"? 2) Why Space Programs are Costly; 3) Background; 4) Aerospace Project Management (Old Culture); 5) Aerospace Project Management (New Culture); 6) Scope of Analysis Limited to Engineering Management Culture; 7) Qualitative Analysis; 8) Some Basic Principles of the New Culture; 9) Cause and Effect; 10) "New Ways of Doing Business" Survey Results; 11) Quantitative Analysis; 12) Recent Space System Cost Trends; 13) Spacecraft Dry Weight Trend; 14) Complexity Factor Trends; 15) Cost Normalization; 16) Cost Normalization Algorithm; 17) Unnormalized Cost vs. Normalized Cost; and 18) Concluding Observations.

CASI

Engineering Management; Space Missions; Technology Assessment; Aerospace Industry

20000068973 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Organizations, Paradigms, and People: The Challenge of KM Interventions

Bailey, Teresa, Jet Propulsion Lab., California Inst. of Tech., USA; Burton, Yvette, Ernst and Young, USA; [1999]; 9p; In English; NetWorking and NetLearning: Knowledge-Management, Networked Learning and Adult Development, 4-6 Jun. 1999, Pasadena, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents viewgraphs on Knowledge Management (KM) and how these interventions are put into practice by organizations and society. The topics include: 1) The Multiple Paradigm Tool; 2) Four Paradigms: tool for the Analyzing Organizations; 3) Assumptions About the Nature of Social Science; 4) Assumptions About the Nature of Society; 5) Schools of Sociological and Organizational Theory; 6) Meaning and Metaphors in the Four Paradigms; and 7) Possibilities and Conclusions.

CASI

Organizations; Sociology; Knowledge

20000069643 Norwegian Defence Research Establishment, Kjeller, Norway

Funding and Organization of Emergency Preparedness in Telecommunications and Electrical Power Supply Systems *Finansiering og Organisering av Beredskap Innen Telekommunikasjon og Kraftforsyning*

Ostby, Eirik, Norwegian Defence Research Establishment, Norway; Hagen, Janne Merete, Norwegian Defence Research Establishment, Norway; Nystuen, Kjell Olav, Norwegian Defence Research Establishment, Norway; Jan. 12, 2000; 42p; In Norwegian; Original contains color illustrations

Contract(s)/Grant(s): FFISYS Proj 769/204.0

Report No.(s): FFI/RAPPORT-2000/00131; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A series of two joint projects between the Directorate for Civil Defence and Emergency Planning and FFI have as main objectives to identify critical vulnerabilities in the national Telecommunications and Electrical Power Supply infrastructures. These objectives include to clarify consequences of service outages, and to evaluate various efforts to reduce the vulnerabilities and the consequences. This report presents the results of a study on the following subjects with respect to emergency preparedness within the two sectors: (1) Legislation and organization. (2) Historical funding. and (3) Discussion of future models for funding. The study concludes that fundings for emergency preparedness have been reduced during the last years. This is worrying in relation to the fact that these infrastructures are increasing vulnerable, and are natural targets for incidents in peacetime as well as in war. The funding models ought to be reviewed in accordance to the ongoing transitions in market and technical developments.

Author

Telecommunication; Electric Power Supplies; Vulnerability

20000070732 Norwegian Defence Research Establishment, Kjeller, Norway

Offset Related Experiences in Large Defence Procurement Projects *Erfaringer Fra Gjenkjopsarbeidet I Storre Materiellanskaffelesprosjekter*

Nicolaysen, Wictor, Norwegian Defence Research Establishment, Norway; May 02, 2000; 34p; In Norwegian; Original contains color illustrations

Report No.(s): FFI/RAPPORT-2000/02695; FFIN/782/732; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarises the experiences from the work carried out by the Norwegian Defence Research Establishment on industrial policies and offset. The experiences are presented as a set of advices on how to conduct the offset related work in large defence procurements.

Author

Norway; Defense Industry; Procurement

20000070755 Interior Dept., Washington, DC USA

Computer and Business Systems Architecture Framework Plan. Trust Management Improvement Project

Feb. 2000; 84p; In English

Report No.(s): PB2000-106178; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

This paper contains the following sections: Executive summary; Introduction; Planning initiation; Business modeling; Trust management system enterprise survey; Current system & technology architecture; Data architecture; Applications architecture; Technology architecture vision; Implementation plan; Planning conclusion; Transition to implementation; Glossary and Appendices.

NTIS

Architecture (Computers); Information Systems; Management Systems

20000070762 Chief Information Officers Council, Washington, DC USA

ROI and the Value Puzzle

Apr. 1999; 68p; In English

Report No.(s): PB2000-106167; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

In October of 1997, Government Computer News along with the Industry Advisory Council and the Federal CIO Council conducted a study to look at government IT investment environment issues such as methodologies for making IT investment decisions, evaluating ROI and ROI barriers, and the overall influence of IT on organizations structure. Twenty-one hundred questionnaires were issued to administrative, operations, CIOs, directors, and managers in both the public and private sectors. The results of this research were reported at the October 1997 IAC Executive Leadership Conference in Richmond, Virginia. The findings of this study serve as a foundation for, and are woven throughout this document. An all-encompassing evaluation of ROI (Return On Investment) can accurately size up an investment's total value to an agency. But, this endeavor is not as easy as it seems because there is no one universally accepted prescription for assessing the value of an investment. Not only do agencies differ in their approaches to calculating value, many times divisions within agencies take varying approaches as well. Herein lies the challenge of evaluating ROI: it must be a standard, repeatable process, while containing a significant degree of flexibility. The process of assessing the total value of an investment informs decision-making, but this task can be difficult to perform without a clear agreement of the definition of terms, or paths to follow.

NTIS

Conferences; Investments; Costs; Management Planning

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.

20000068446 Centers for Disease Control, Office of Data Research, and Vital Statistics, Atlanta, GA USA

Standardized Reporting Using Crash Outcome Data Evaluation System (CODES)

Finison, K. S.; Apr. 2000; 36p; In English; Prepared in cooperation with Maine Health Information Center, Augusta, GA

Report No.(s): PB2000-105861; No Copyright; Avail: National Technical Information Service (NTIS)

While CODES projects have expanded to 25 states, there is no standardized reporting the outcome measures that are available with linked data. This paper describes the authors' efforts to build a standard format for reporting these outcomes. This format is conceptualized by laying the injury 'pyramid' on its side. Outcome measures are reported as columns across a page with increasing levels of severity from left to right. The authors discuss several aspects of format development including levels of reporting, specific outcome measures, rates, and selection of appropriate denominators.

NTIS

Data Systems; Standardization; Accidents; Crashes

20000068970 Defense Systems Management School, Fort Belvoir, VA USA

Acquisition Guide for Interactive Electronic Technical Manuals

McMahon, Paul T.; McDaniel, Norman A.; Riffee, John; Apr. 2000; 175p; In English

Report No.(s): AD-A376398; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

This document is designed to be the primary desk reference for acquisition personnel who will he required to acquire, develop, deliver and/or manage IETMS. It incorporates the status of existing/planned DoD and Service-unique policy guidance; discusses current and projected technologies related to the production of IETMs; analyzes the relationship between IETMs and training; and addresses delivery vehicles -- including the World Wide Web (WWW).

DTIC

Technology Assessment; Manuals; Acquisition

20000069003 MRJ Technology Solutions, Moffett Field, CA USA

Large Field Visualization with Demand-Driven Calculation

Moran, Patrick J., MRJ Technology Solutions, USA; Henze, Chris, MRJ Technology Solutions, USA; [1999]; 8p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-72; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We present a system designed for the interactive definition and visualization of fields derived from large data sets: the Demand-Driven Visualizer (DDV). The system allows the user to write arbitrary expressions to define new fields, and then apply a variety of visualization techniques to the result. Expressions can include differential operators and numerous other built-in functions, ail of which are evaluated at specific field locations completely on demand. The payoff of following a demand-driven design philosophy throughout becomes particularly evident when working with large time-series data, where the costs of eager evaluation alternatives can be prohibitive.

Author

Differential Equations; Operators (Mathematics)

20000069368 Government Printing Office, Library Programs Service, Washington, DC USA

Proceedings of the 8th Annual Federal Depository Conference

MacGilvray, M. W.; 1999; 286p; In English; 8th; Federal Depository, 12-15 Apr. 1999, Bethesda, MD, USA

Report No.(s): PB2000-103225; No Copyright; Avail: National Technical Information Service (NTIS)

This publication presents an agenda of the depository library council and federal depository conference. The conference was held at the Holiday Inn in Bethesda, Maryland on April 12-15, 1999.

NTIS

Conferences; Libraries; Documents

20000069640 NCI Information Systems, Inc., Hanover, MD USA

NASA Thesaurus Supplement: A Three-Part Cumulative Update of the 1998 Edition of the NASA Thesaurus, Supplement 5

July 2000; 34p; In English

Report No.(s): NASA/SP-2000-7501/SUPPL5; NAS 1.21:7501/SUPPL5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA Thesaurus Supplement is a cumulative update to the 1998 edition of the NASA Thesaurus (NASA/SP-1998-7501). The Supplement, published every 6 months, includes all new terms and associated hierarchies added since the cutoff for the 1998 edition (December 1997). Parts 1 and 2 (Hierarchical Listing and Rotated Term Display) correspond to Volumes 1 and 2 of the 1998 printed edition of the NASA Thesaurus. Definitions are included in Part 1; uppercase/lowercase forms are provided in both Parts 1 and 2. Part 3 is a list of deletions or changes to valid terms.

Author

Thesauri; Terminology; Dictionaries; Terms

20000070324 Army War Coll., Carlisle Barracks, PA USA

Developing and Retaining Information Warriors: An Imperative to Achieve Information Superiority

Miller, Russell F.; Feb. 29, 2000; 38p; In English

Report No.(s): AD-A377713; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Developing effective policy, doctrine, organizations, technology, and most importantly, skilled people are essential to ensure our warfighters enjoy information superiority across the spectrum of conflict. In this context, "information warriors"-people skilled in the art of conducting information operations-are essential to achieving information superiority. Information warriors

must be multi-skilled-at a minimum, proficient in operations, intelligence and information technologies. Unfortunately, all military services face significant challenges in retaining information technology (IT) professionals-people with many of the critical skills needed to conduct effective information operations. This paper analyzes Air Force IT retention and its impact on achieving information superiority. In this context, information superiority is the desirable end-state, information operations the way to win it, and standing up a new Air Force Information Operations (IO) career field the best way to retain the IT professionals needed to achieve it. Key reasons IT professionals leave the Air Force are identified, leading to the conclusion that to improve IT retention, the Air Force must do a better job addressing both tangible and non-tangible satisfiers. Besides aiding IT retention, a separate Air Force IO career track is the best way to develop %information warriors"-the people warfighters will task to win information superiority on future battlefields. Joint vision 2010 makes it clear that attracting and retaining people with the intellect, training and motivation to prevail across the spectrum of military operations is critical to the future success of our forces. To that end, developing and retaining "information warriors" capable of conducting decisive information operations is a strategic, operational and tactical imperative. to fail in this endeavor will significantly jeopardize our ability to prevail in future conflicts.
DTIC

Information Systems; Intelligence; Military Operations; Tactics; Military Technology; Information Theory; Personnel Management

20000070440 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
Unclassified Publications of Lincoln Laboratory, 1 January - 31 December 1999. Volume 25
Means, Patricia A.; Seidel, Robert C.; Dec. 31, 1999; 62p; In English
Contract(s)/Grant(s): F19628-95-C-0002
Report No.(s): AD-A377793; ESC-TR-99-062-VOL-25; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Volume 25 of Unclassified Publications of Lincoln Laboratory lists reports published from 1 January to 31 December 1999, as well as updated information on earlier publications. Documents listed herein are generally no longer available from Lincoln Laboratory. Qualified Defense Technical Information Center (DTIC) users may purchase copies through normal DTIC channels. Others may purchase photocopies or microfiche from the U.S. Department of Commerce, National Technical Information Service, Springfield, Virginia 22161. When ordering, the six-digit AD number should be cited. Subscriptions of the MIT LincoLn Laboratory Journal are free of charge, but provided only to qualified recipients (government employees and contractors, libraries, university faculty, and R&D laboratories).
DTIC
Documents; Technical Writing; Bibliographies

20000070730 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
Military Information Operations Analysis Using Influence Diagrams and Coloured Petri Nets
Staker, R. J., Defence Science and Technology Organisation, Australia; December 1999; 82p; In English
Report No.(s): DSTO-TR-0914; DODA-AR-011-162; Copyright; Avail: Issuing Activity

This report describes how Influence Diagrams, Coloured Petri Net models and related techniques may be used to analyse certain aspects of Military Information Operations. An example is employed to demonstrate these techniques. The example used is a very simplified representation of a Military Command Organization dealing with a decision problem. The objective of the report is to provide theory, methods and techniques to support the assessment of the effect of Military Information Operations on such organizations. The simplicity of the example permits the basic concepts to be clearly conveyed. They may readily be extended to the analysis of more complex examples as required. The most fundamental and significant concept developed in this report is that of a common quantitative measure of effectiveness that encompasses all types of Information Operations relevant to Information Warfare, This permits the direct comparison of the effectiveness of alternative Information Operation options with one another and also with conventional operations options. This latter ability is essential if Information Operations are to be employed appropriately as part of a broader range of military options.
Author
Military Operations; Information Theory; Petri Nets

20000070741 Army War Coll., Carlisle Barracks, PA USA
Making Information Work - A New Approach to Information Management for the 21st Century
Perry, Hugh; Apr. 10, 2000; 33p; In English
Report No.(s): AD-A377642; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper will evaluate the USA Government's ability to utilize the informational element of power. It will examine the organizational structure and composition of the Executive Branch of the U.S. Government and assess its capacity to plan, coordinate,

and manage the use of information in support of U.S. foreign policy and national security objectives. The paper will begin with defining what information is in the context of national power. It will examine future trends in foreign policy and national security as related to the elements of national power and demonstrate the increased need for the United States to possess a cohesive, well-choreographed, and synergistic information capacity. Finally, a few concluding thoughts will be offered along with several recommendations on how the USA Government can more adroitly manage information in the 21st century.
DTIC
Information Management; Information Transfer; Data Management; Information Systems

20000070754 National Association of State Information Resource Executives, Lexington, KY USA
State Human Service Information Systems: Measuring the Impact of Welfare Reform
2000; 32p; In English; Original contains color illustrations
Report No.(s): PB2000-106181; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report focuses on the following: The impact of the PROWRA and human services reform initiatives on IT spending and staffing, as well as determining who in states are participating in IT initiatives; The impact of the availability of new technologies and information age management approaches on human services reform efforts; The type of IT initiatives underway in states to support reform and modernization efforts; and The impact of the protracted finalization of new PRWORA reporting requirements. A year has passed since the 1998 NASIRE report was published. During that time, the 178 data elements proposed by the ACF remained a source of uncertainty. State information technology and human services agencies, however, have moved forward in meeting the more clearly defined needs of their own PRWORA-inspired reform efforts. This report will review the progress of states in meeting the ACF data reporting requirements, despite the uncertainty created by delays in the release of the requirements.
NTIS
Information Management; Information Systems; Human Relations

20000072462 Army War Coll., Carlisle Barracks, PA USA
The Affects of Presidential Decision Directive 63 on the Public
Smulian, Paul R.; Apr. 01, 2000; 29p; In English
Report No.(s): AD-A377416; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Specific recommendations made in a report by The President's Commission on Critical Infrastructure resulted in Presidential Decision Directive 63 (PDD-63). PDD-63 complimented actions initiated under Presidential Decision Directive 39 (PDD-39) and specifically targeted the nation's cyber-infrastructure for protection. In December 1999, the Federal Government's plan entitled "Defending America's Cyberspace: National Plan for Information Systems Protection", was finalized and signed by the President. This report analyzes the Federal Government's plan and determines what affects the plan will have on the citizens of the USA. Infrastructure Protection covers a wide array of problems presented to the government and private industry of the USA. Worldwide accessibility to the Internet coupled with motive, opportunity, and cheap and accessible tools enable many types of attacks upon the networks, computers, databases, and control mechanisms that are attached to this worldwide network of networks. A relatively small group of citizens from the private and public sectors as well as the Military sector recognized the threat that was posed by this accessibility and set out to counter the threat efficiently and effectively. The result of their efforts was Presidential Decision Directive 63. This directive will forge the way for the future for infrastructure security of computer information systems and networks for the next century.
DTIC
Information Systems; Presidential Reports; Computer Networks; Computer Information Security

20000073280 Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA
A Survey of Legacy System Modernization Approaches *Final Report*
Comella–Dorda, Santiago; Wallnau, Kurt; Seacord, Robert C.; Robert, John; Apr. 2000; 30p; In English
Contract(s)/Grant(s): F19628-95-C-0003
Report No.(s): AD-A377453; CMU/SEI-2000-TN-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Information systems are critical assets for modern enterprises and incorporate key knowledge acquired over the life of an organization. Although these systems must be updated continuously to reflect evolving business practices, repeated modification has a cumulative effect on system complexity, and the rapid evolution of technology quickly renders existing technologies obsolete. Eventually, the existing information systems become too fragile to modify and too important to discard. However, organizations must consider modernizing these legacy systems to remain viable. The commercial market provides a variety of solutions to this increasingly common problem of legacy system modernization. However, understanding the strengths and weaknesses of each modernization technique is paramount to select the correct solution and the overall success of a modernization effort. This paper provides a

survey of modernization techniques including screen scraping, database gateway, XML integration, database replication, CGI integration, object-oriented wrapping, and "componentization" of legacy systems. This general overview enables engineers performing legacy system modernization to preselect a subset of applicable modernization techniques for further evaluation.
DTIC
Data Bases; Software Engineering; Object-Oriented Programming

20000073311 Army Construction Engineering Research Lab., Champaign, IL USA

Errors in Environmental Assessments: An Error-Budget Model for Plant Populations *Final Report*

Cao, Xiangchi; Gertner, George; MacAllister, Bruce; Anderson, Alan; Apr. 2000; 42p; In English

Report No.(s): AD-A377507; ERDC/CERL-TR-00-12; SERDP-CS-1096; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The assumption that a data set used for any mathematical or computer modeling is error-free is an underlying premise of theoretical modeling. However, the assumptions of error-free data and models usually do not hold true in the real world. Error is a natural property of surveys and modeling. Consequently, error should be taken into account when developing any type of model. The goal of this project is to create an error-budget model for a population dynamics model of plant communities. Once developed, this error-budget model can in turn be used for a number of other purposes such as data correction, model evaluation, quality control, and management decisionmaking.
DTIC
Mathematical Models; Data Management; Error Analysis; Plants (Botany); Environment Effects

20000073398 BAE Systems, UK

Monitoring and Intelligent Use of Data 'Turning Water into Wine': Proceedings

[2000]; 104p; In English; Monitoring and Intelligent Use of Data 'Turning Water into Wine', 28 Mar. 2000, London, UK; Sponsored by Royal Aeronautical Society, UK; See also 20000073399 through 20000073406; Original contains color illustrations; ISBN 1-85768-182-7; Copyright; Avail: Issuing Activity

Not long after Stewart Hughes Ltd (SHL) started to install FDR/HUM systems on North Sea helicopters (circa 1990), thoughts began to gel on how better use could be made of what was undoubtedly an expensive and heavy system. In particular, that having fitted such a powerful system for the gathering and processing of flight as well as health data, perhaps now was the time to think seriously about helping the pilots, as opposed to the original 'benefactor', i.e. the maintainer. The HARP report of the early 1980s had put cockpit problems at the top of the list for help, but at some later point the decision was made to put the then scarce R&D resources behind the less intractable problem of mechanical health monitoring. Even to this day, the aircraft's crew perform a largely 'postman' type of service for HUM, gaining little or no direct benefit, and this somewhat conflicts with accident statistics that place the crew at the forefront of accident causes. It therefore suggests that a system aimed principally at improving safety, and one so computationally powerful and data intensive as the HUM, should try to do more to help the crew. Hence, from an early time, the idea of using HUM data to generate pilot alerts arose. In the beginning, this centred round fairly simple functions such as the calculation of low airspeeds, aircraft weight, CG and range, all based purely on use of FDR data. Latterly, however, we have seen more sophisticated functions being suggested. For example, to do with the vortex ring state (VRS) - essentially a low airspeed/high descent rate/pilot disorientation type of phenomenon - where pilots may have, for example, turned tail into wind, become entangled in VRS and lost control. Such states are also sometimes experienced by pilots executing a steep descent, or turning into a landing site and unconsciously transferring their airspeed reference from that of the airmass to some fixed position on the ground. Added to this, the HUM data was proving difficult to interpret in anything but the simplest of scenarios. In hindsight many possible causes for this can be given: lack of training, inevitable immaturities in the systems and just the sheer number of failure modes that some of the HUM systems were set up to monitor. However, for SHL systems at least, it was fundamentally to do with the problem of setting thresholds for vibration measurements.
Derived from text
Aircraft Pilots; Cockpits; Disorientation; Education; Failure Modes; Health; Vibration Measurement

20000073399 Bristow Helicopters Ltd., Redhill, UK

IHUMS Data Collection and Analysis: Operators' Perspective

Dobson, Ian, Bristow Helicopters Ltd., UK; Monitoring and Intelligent Use of Data 'Turning Water into Wine': Proceedings; [2000], pp. 1.1 - 1.5; In English; See also 20000073398; Copyright; Avail: Issuing Activity

The Bristow IHUMS fleet of 69 aircraft generates enormous amounts of data daily, Approximately l00MB per day for the Aberdeen operation alone. The ground-stations do a good job of processing and diagnosing all the parameters to extract and highlight excursions that are the vital indicators of transmission health, rotor health and usage. Engineers in working with the system

are becoming increasingly more adept at interpreting the data but are often frustrated by the shortcomings of what is after all, a first generation system. Transmission vibration acquisitions are only short duration samplings, screen presentations are restricted to one aircraft at a time. There is no trending capability for rotor vibration. Downloaded FDR information is only a series of short duration snap shots and the data transfer medium with only 2MB capacity severely limits the number of acquisitions. This is not to say that HUMS fails in its design concept, on the contrary a steady stream of successful early fault detections and an ever increasing faith and dependence in the system is evident. However the early techniques have opened up other possibilities and they are constantly presenting themselves as operators gain HUMS experience. HUMS needs to advance with technology and comply with AAIB recommendations. The new IHUMS Windows NT version will meet most of the requirements but the airborne aspect needs to be provided with an greater capacity for data retention and transfer to the ground-station. This could enable full FDR download and access to all parameters recorded during the flight and an ability for aircraft to carry its HUMS trend histories with it from base to base.
Author
Data Acquisition; Frustration; Ground Stations; Vibration

20000073400 Rolls-Royce Ltd., Strategic Research Centre, Derby, UK
Intelligent Management of Engine Data
Cowley, Peter, Rolls-Royce Ltd., UK; Hesketh, Graham, Rolls-Royce Ltd., UK; Monitoring and Intelligent Use of Data 'Turning Water into Wine': Proceedings; [2000], pp. 3.1 - 3.4; In English; See also 20000073398; Copyright; Avail: Issuing Activity

Rolls-Royce has supplied its customers with the COMPASS data collection system for many years. The information from these systems has been analysed by our Airline customers using trending and manual inspection of performance charts by skilled engineers. Small operators have had some difficulty in benefiting from the information collected by their data collection systems. They lack large, fleet wide databases from which to build case history libraries and they may have difficulty supporting the manpower needed to inspect the trend charts produced. Recently, Rolls-Royce has set up a joint venture company with Science Applications International Corporation. The new company, Data Systems and Solutions is providing a data handling and analysis service for operators. This not only makes detailed operational data analysis available to smaller operators, but allows all operators to benefit from Rolls-Royce detailed knowledge of engine design and performance. Rolls-Royce benefits too in obtaining objective engine reliability data. Rolls-Royce Strategic Research Centre has been developing novelty detection systems for monitoring engine health and indeed for monitoring manufacturing and business processes. These systems are targeted at future engine designs and at engine development testing, but it has become clear that the methods we have been using may also be applied to COMPASS data. The benefits of doing this are two fold. Firstly, the routine scanning of the large volume of data collected can be delegated to novelty detection software. Secondly, flight to flight variation in the parameters being trended can be substantially reduced which allows changes in the trend to be identified earlier and with increased confidence.
Author
Data Acquisition; Data Systems; Collection; Procedures; Manuals; Flight Characteristics; Airline Operations

20000073401 MJA Dynamics Ltd., Southampton, UK
Ground Station System Development: In Vino Veritas
Boakes, Steve, MJA Dynamics Ltd., UK; Monitoring and Intelligent Use of Data 'Turning Water into Wine': Proceedings; [2000], pp. 4.1 - 4.8; In English; See also 20000073398; Copyright; Avail: Issuing Activity

The Ground Station System (GSS) is now generally recognized as the 'ground-based' computer that provides the interface between the data generated by airborne monitoring systems and the maintenance function. GSS technology is considered critical to the effectiveness of health & usage monitoring systems (HUMS). With a GSS in this principal role significant benefits have already been achieved. However, in the face of continuing challenges to maximize and fully integrate the maintenance management benefits of airborne monitoring combined with the ever-changing face of information technology, the efficient development of GSS technology requires a strategic approach and skillfully engineered development. This paper describes key requirements, functionality and top-level architecture of the modem GSS. It examines some current challenges, and suggests skills and approaches required to deliver the next generation of effective, compatible and compliant systems. A number of Smiths Industries (SI) activities are described which are advancing to achieve this goal.
Author
Ground Stations; Ground Based Control; Information Systems; Technology Assessment

20000073402 Eurocopter France, Marignane, France
HUMS for Eurocopter Light and Medium Helicopters
Pouradier, J. M., Eurocopter France, France; Lubrano, P., Eurocopter France, France; Monitoring and Intelligent Use of Data

'Turning Water into Wine': Proceedings; [2000], pp. 6.1 - 6.8; In English; See also 20000073398; Copyright; Avail: Issuing Activity

Eurocopter involvement in HUMS is a long lasting story, dating back to 1981. This early and continuous engagement is motivated by Eurocopter' conviction that the involvement of the helicopter manufacturer in HUMS development and support is a key element in making HUMS a valuable tool for the operators. The experience gained on Super Puma, more than 70 of which are equipped with EuroHUMS(TM) or EuroARMS(TM), reinforced our conviction and encouraged us to make the HUMS benefits available to operators of medium and light helicopters. But the HUMS affordability issue becomes more critical as the aircraft size decreases. This paper describes the means Eurocopter chose to make HUMS affordable on medium and light helicopters.
Author

Military Helicopters; Operating Systems (Computers)

20000073404 British Airways, Heathrow, UK

Operational Data Monitoring: Experiences Good and Bad

Savage, John, British Airways, UK; Monitoring and Intelligent Use of Data 'Turning Water into Wine': Proceedings; [2000], pp. 9.1 - 9.3; In English; See also 20000073398; Copyright; Avail: Issuing Activity

The purpose of this paper is to give a practical view of what can be done in Operational Flight Data Monitoring using current technology. Although many of the illustrations I will give come from the British Airways OFDM programme, I hope to make my main points more general i.e. they apply equally to any OFDM programme. Throughout I will emphasise areas of difficulty, and how important it is to overcome them.
Author

Data Processing; Data Management; Flight Characteristics

20000073405 Stewart Hughes Ltd., Southhampton, UK

A Trial Helicopter Operations Monitoring Programme (HOMP)

Larder, Brian, Stewart Hughes Ltd., UK; Norman, Nick, Bristow Helicopters Ltd., UK; Monitoring and Intelligent Use of Data 'Turning Water into Wine': Proceedings; [2000], pp. 10.1 - 10.8; In English; See also 20000073398; Copyright; Avail: Issuing Activity

In recent years advances in technical safety of large helicopters have been achieved through the implementation of Health and Usage Monitoring Systems (HUMS). These systems have provided improved information on the integrity of the helicopter powertrain. All HUM systems have been introduced on the back of a mandatory requirement to fit Flight Data Recorders (FDRs). Until now, however, the flight data stored in the FDRs has only been used in a reactive manner for the analysis of incidents and accidents. Many airlines operating fixed wing aircraft have adopted a pro-active approach to improving operational safety by analysing flight data on a routine basis to provide better visibility of their operations. This paper describes the trial of a helicopter version of this approach, known as a Helicopter Operations Monitoring Programme (HOMP), with the goal of further improving helicopter operational safety by making better use of the existing FDR data.
Author

Airline Operations; Commercial Aircraft; Flight Recorders; Helicopters; Safety

20000073406 British Airways, UK

Royal Aeronautical Society Conference Monitoring and Intelligent Use of Data: Turning Water into Wine. Analysing and Presenting HOMP Data

Rogan, Eddie, British Airways, UK; Monitoring and Intelligent Use of Data 'Turning Water into Wine': Proceedings; [2000], pp. 11.1 - 11.9; In English; See also 20000073398; Original contains color illustrations; Copyright; Avail: Issuing Activity

British Airways (BA) started using flight data recorders nearly 40 years ago and for the last 30 years all its pilots have taken for granted that their operations have been recorded and analysed by an exceedence program. For the last ten years all of the British Airways flight data collected has been analysed and presented as useful information using several BASIS (British Airways Safety Information System) modules. The BASIS suite of Flight Data modules was chosen for the Helicopter Operations Monitoring Programme (HOMP) trial to extract, decode, analyse and present flight data information stored on the trial QARs (Quick Access Recorders). This paper describes how the BASIS Flight Data modules used in the trial turn raw flight data from the recorder of a Helicopter into useful information that can be analysed and presented on the ground.
Author

Safety; Information Systems; Helicopters; Flight Recorders

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20000073709 Naval Postgraduate School, Monterey, CA USA

Developing and Maintaining a Useful Financial Management Handbook for Department of Defense Financial Managers

Bambao, Marie; Dec. 1999; 237p; In English

Report No.(s): AD-A374358; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The 13-week Financial Management in the Armed Forces and the two-week Practical Comptrollership are two classes offered at the Naval Postgraduate School, Monterey, California. The primary instructional material used for these two courses is the Practical Comptrollership handbook. As new financial management directives and guidance from the Office of Management and Budget (0MB), the Department of Defense (DoD), and the Department of the Navy (DoN) are implemented, financial management in the DoN is modified. The purpose of this research was to update the material contained in the Practical Comptrollership handbook to reflect changes in financial management policies and practices. This research investigated legislation, 0MB, DoD, and DoN directives and budget guidance to incorporate the latest financial management information and processes. This research provides the most up-to-date information currently available to financial managers to assist them in improving the efficiency of financial systems and reduce costs.

DTIC

Financial Management; Management Information Systems; Handbooks

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TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see 03 Air Transportation and Safety, 16 Space Transportation and Safety, and 44 Energy Production and Conversion. For specific technology transfer applications see also the category where the subject is treated.

20000069356 Lund Univ., Dept. of Traffic Planning and Engineering, Sweden

Public Transport: Leading Research Environments and Operating Systems *Kollektivtrafik: Framstaende Forskningsmiljoeer och Operativa System*

Peterson, B. E.; 1999; 44p; In Swedish

Report No.(s): PB2000-102756; No Copyright; Avail: National Technical Information Service (NTIS)

In 1996, the Swedish Transport and Communications Research Board (KFB) commissioned the Department to conduct a survey of good examples of local and regional public transport operations in Sweden and also to determine which departments at universities and colleges outside of Sweden conduct research within the public transport area. In view of plans for updating the reports and extending their scope, the Department was asked by KFB to conduct a follow-up survey of the use and usefulness of the reports and the database in their present form.

NTIS

Transportation; Sweden

89
ASTRONOMY

Includes observations of celestial bodies, astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20000070736 NASA Marshall Space Flight Center, Huntsville, AL USA

Spectral Evolution in GRB 990510

Vreeswijk, P. M., Amsterdam Univ., Netherlands; Rol, E., Amsterdam Univ., Netherlands; Galama, T. J., Amsterdam Univ., Netherlands; Wijers, R. A. M. J., State Univ. of New York, USA; vanParadijs, J., Amsterdam Univ., Netherlands; Kouveliotou, C., NASA Marshall Space Flight Center, USA; Frontera, F., Consiglio Nazionale delle Ricerche, Italy; Pian, E., Consiglio Nazionale delle Ricerche, Italy; Palazzi, E., Consiglio Nazionale delle Ricerche, Italy; Masetti, N., Consiglio Nazionale delle Ricerche, Italy; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We present time-resolved spectroscopy of the afterglow of GRB 990510. Through the identification of several absorption lines in the first epoch spectrum, we determine the redshift for this burst to be z is greater than = 1.6190 +/- 0.0016. No clear emission lines are detected. From the absence of the Ly.alpha drop, we can put an upper limit to the redshift of z is less than or equal to 2.3. We study the time evolution of the MgII absorption line in our spectra taken 0.8 and 3.9 days after the burst, whose equivalent width (E.W.) is expected to change in case the burst resides in a dense compact medium (Perna & Loeb 1998). We measure

an E.W. of 2.5 /- 0.2 and 2.3 +/- 0.6 in the spectra 0.8 and 3.8 days after the burst, respectively. Our results suggest that the atoms responsible for the absorption are not in the vicinity of the site of the burst.
Author
Spectroscopy; Spectrum Analysis; Spectral Emission; Gamma Ray Bursts; Afterglows

20000070751 NASA Marshall Space Flight Center, Huntsville, AL USA
The Distance and Mass of the Galaxy Cluster Abell 1995 Derived From Sunyaev-Zel'dovich Effect and X-Ray Measurements
Patel, Sandeep K., NASA Marshall Space Flight Center, USA; Joy, Marshall, NASA Marshall Space Flight Center, USA; Carlstrom, John E., Chicago Univ., USA; Holder, Gilbert P., Chicago Univ., USA; Reese, Erik D., Chicago Univ., USA; Gomez, Percy L., Rutgers Univ., USA; Hughes, John P., Rutgers Univ., USA; Grego, Laura, Harvard-Smithsonian Center for Astrophysics, USA; Holzapfel, William L., California Univ., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only
    We present multi-wavelength observations of the Abell 1995 galaxy cluster. From analysis of x-ray spectroscopy and imaging data we derive the electron temperature, cluster core radius, and central electron number density. Using optical spectroscopy of 15 cluster members, we derive an accurate cluster redshift and velocity dispersion. Finally, the interferometric imaging of the SZE toward Abell 1995 at 28.5 GHz provides a measure of the integrated pressure through the cluster.
Author
Mass; Galactic Clusters; Red Shift

20000070849 NASA Ames Research Center, Moffett Field, CA USA
Atmospheric Dynamics on Venus, Jupiter, and Saturn: An Observational and Analytical Study *Final Report, 1 Jul. 1996 - 30 Apr. 2000*
Bridger, Alison, San Jose State Univ., USA; Magalhaes, Julio A., NASA Ames Research Center, USA; Young, Richard E., NASA Ames Research Center, USA; May 31, 2000; 17p; In English
Contract(s)/Grant(s): NCC2-955; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    Determining the static stability of Jupiter's atmosphere below the visible cloud levels is important for understanding the dynamical modes by which energy and momentum are transported through Jupiter's deep troposphere. The Galileo Probe Atmospheric Structure Investigation (ASI) employed pressure and temperature sensors to directly measure these state variables during the parachute-descent phase, which started at a pressure (p) of 0.4 bars and ended at p= 22 bars. The internal temperature of the probe underwent large temperature fluctuations which significantly exceeded design specifications. Corrections for these anomalous interior temperatures have been evaluated based on laboratory data acquired after the mission using the flight spare hardware. The corrections to the pressure sensor readings was particularly large and the uncertainties in the atmospheric pressures derived from the p sensor measurements may still be significant. We have sought to estimate the formal uncertainties in the static stability derived from the p and T sensor measurements directly and to devise means of assessing the static stability of Jupiter's atmosphere which do not rely on the p sensor data.
Derived from text
Atmospheric Physics; Jupiter (Planet); Jupiter Atmosphere; Static Stability; Troposphere; Venus (Planet); Saturn (Planet)

20000070860 Lunar and Planetary Inst., Houston, TX USA
Extra-Solar Planets: Searching for Other Planetary Systems
Black, David C., Lunar and Planetary Inst., USA; Encyclopedia of the Solar Systems; 1999, pp. 941-955; In English; Copyright; Avail: Issuing Activity
    The presence of a chapter dealing with the topic of other planetary systems in an encyclopedia of this type is remarkable in at least two ways, It is remarkable because what might be considered a cousin of a planetary system, planets revolving around a pulsar, has been recently discovered, and there have been discoveries of what may turn out to be planetary companions to other stars. However, until the nature of these companions is clear, there is at present no unequivocal observational evidence of any other planetary system. The distinction between all of these is discussed later in the chapter. This chapter is also remarkable because it is explicit recognition of the fact that information from a comprehensive search for other planetary systems is essential to understanding the origin and early evolution of our own planetary system. [See THE SOLAR SYSTEM AND ITS PLACE IN THE GALAXY.] We have been able to construct a paradigm as to how the solar system, and by inference other planetary systems, formed. That paradigm is in large measure built upon a foundation of data from the study of objects in the solar system, as well as upon general features of the solar system. These features include, but are not limited to, the orbital architecture of the solar

system and the general trend in compositions of the planets. A scientific test of that paradigm must come by using it to predict both the frequency of occurrence of planetary systems and their general features.
Derived from text
Planetary Systems; Solar System; Galaxies; Planetary Evolution

20000072444 NASA Goddard Space Flight Center, Greenbelt, MD USA

Thermal Design to Meet Stringent Temperature Gradient/Stability Requirements of SWIFT BAT Detectors

Choi, Michael K., NASA Goddard Space Flight Center, USA; [2000]; 10p; In English; 35th; 35th Intersociety Energy Conversion Engineering Conference, 24-27 Jul. 2000, Las Vegas, NV, USA
Report No.(s): AIAA Paper 2000-2905; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Burst Alert Telescope (BAT) is an instrument on the National Aeronautics and Space Administration (NASA) SWIFT spacecraft. It is designed to detect gamma ray burst over a broad region of the sky and quickly align the telescopes on the spacecraft to the gamma ray source. The thermal requirements for the BAT detector arrays are very stringent. The maximum allowable temperature gradient of the 256 cadmium zinc telluride (CZT) detectors is PC. Also, the maximum allowable rate of temperature change of the ASICs of the 256 Detector Modules (DMs) is PC on any time scale. The total power dissipation of the DMs and Block Command & Data Handling (BCDH) is 180 W. This paper presents a thermal design that uses constant conductance heat pipes (CCHPs) to minimize the temperature gradient of the DMs, and loop heat pipes (LHPs) to transport the waste heat to the radiator. The LHPs vary the effective thermal conductance from the DMs to the radiator to minimize heater power to meet the heater power budget, and to improve the temperature stability. The DMs are cold biased, and active heater control is used to meet the temperature gradient and stability requirements.
Author
Active Control; Conductive Heat Transfer; Heat Pipes; Heat Radiators; Spacecraft Temperature

20000072482 NASA Ames Research Center, Moffett Field, CA USA

Spatial Variation of the 3.29 and 3.40 Micron Emission Bands Within Reflection Nebulae and The Photochemical Evolution of Methylated Polycyclic Aromatic Hydrocarbons

Joblin, C., NASA Ames Research Center, USA; Tielens, A. G. G. M., NASA Ames Research Center, USA; Allamandola, L. J., NASA Ames Research Center, USA; Geballe, T. R., Joint Astronomy Centre, USA; Astrophysical Journal; Feb. 20, 1996; Volume 458, pp. 610-620; In English; Copyright; Avail: Issuing Activity

Spectra of 3 microns emission features have been obtained at several positions within the reflection nebulae NGC 1333 SVS3 and NGC 2023. Strong variations of the relative intensities of the 3.29 microns feature and its most prominent satellite band at 3.40 microns are found. It is shown that: (1) the 3.40 microns band is too intense with respect to the 3.29 microns band at certain positions to arise from hot band emission alone, (2) the 3.40 microns band can be reasonably well matched by new laboratory spectra of gas-phase polycyclic aromatic hydrocarbons (PAHs) with alkyl (-CH3) side groups, and (3) the variations in the 3.40 microns to 3.29 microns band intensity ratios are consistent with the photochemical erosion of alkylated PAHs. We conclude that the 3.40 microns emission feature is attributable to -CH3 side groups on PAH molecules. We predict a value of 0.5 for the peak intensity ratio of the 3.40 and 3.29 microns emission bands from free PAHs in the diffuse interstellar medium, which would correspond to a proportion of one methyl group for four peripheral hydrogens. We also compare the 3 microns spectrum of the protoplanetary nebula IRAS 05341 + 0852 with the spectrum of the planetary nebula IRAS 21282 + 5050. We suggest that a photochemical evolution of the initial aliphatic and aromatic hydrocarbon mixture formed in the outflow is responsible for the changes observed in the 3 microns emission spectra of these objects.
Author
Spatial Distribution; Aliphatic Hydrocarbons; Alkyl Compounds; Emission Spectra; Methyl Compounds; Planetary Nebulae; Polycyclic Aromatic Hydrocarbons

20000072575 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Trans-Pacific Astronomy Experiment Project Status

Hsu, Eddie, Jet Propulsion Lab., California Inst. of Tech., USA; 2000; 19p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Trans-Pacific Astronomy Experiment is Phase 2 of the Trans-Pacific High Data Rate Satcom Experiments following the Trans-Pacific High Definition Video Experiment. It is a part of the Global Information Infrastructure-Global Interoperability for Broadband Networks Project (GII-GIBN). Provides global information infrastructure involving broadband satellites and terrestrial networks and access to information by anyone, anywhere, at any time. Collaboration of government, industry, and academic

organizations demonstrate the use of broadband satellite links in a global information infrastructure with emphasis on astronomical observations, collaborative discussions and distance learning.
Derived from text
Communication Satellites; Satellite Networks

20000072579 California Inst. of Tech., Submillimeter Observatory, Pasadena, CA USA

Infrared Observations of Hot Gas and Cold Ice Toward the Low Mass Protostar Elias 29

Boogert, A. C. A., Kapteyn Astronomical Lab., Netherlands; Tielens, A. G. G. M., Kapteyn Astronomical Lab., Netherlands; Ceccarelli, C., Observatoire de Grenoble, France; Boonman, A. M. S., Leiden Observatory, Netherlands; vanDishoeck, E. F., Leiden Observatory, Netherlands; Keane, J. V., Kapteyn Astronomical Lab., Netherlands; Whittet, D. C. B., Rensselaer Polytechnic Inst., USA; deGraauw, T., Space Research Organization Netherlands, Netherlands; [2000]; 22p; In English
Contract(s)/Grant(s): JPL-961624; NAG5-7598; NAG5-7884
Report No.(s): Rept-2000-9; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    We have obtained the full 1-200 micrometer spectrum of the low luminosity (36 solar luminosity Class I protostar Elias 29 in the rho Ophiuchi molecular cloud. It provides a unique opportunity to study the origin and evolution of interstellar ice and the interrelationship of interstellar ice and hot core gases around low mass protostars. We see abundant hot CO and H_2O gas, as well as the absorption bands of CO, CO_2, H_2O and "6.85 micrometer" ices. We compare the abundances and physical conditions of the gas and ices toward Elias 29 with the conditions around several well studied luminous, high mass protostars. The high gas temperature and gas/solid ratios resemble those of relatively evolved high mass objects (e.g. GL 2591). However, none of the ice band profiles shows evidence for significant thermal processing, and in this respect Elias 29 resembles the least evolved luminous protostars, such as NGC 7538 : IRS9. Thus we conclude that the heating of the envelope of the low mass object Elias 29 is qualitatively different from that of high mass protostars. This is possibly related to a different density gradient of the envelope or shielding of the ices in a circumstellar disk. This result is important for our understanding of the evolution of interstellar ices, and their relation to cometary ices.
Author
Gas Temperature; Ice; Infrared Astronomy; Protostars; Mass; Solar Radiation; Ophiuchi Clouds

20000073239 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Catalog of Soft X-Ray Shadows, and More Contemplation of the 1/4 KeV Background

Snowden, S. L., NASA Goddard Space Flight Center, USA; Freyberg, M. J., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Kuntz, K. D., Maryland Univ., USA; Sanders, W. T., Wisconsin Univ., USA; [1999]; 34p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    This paper presents a catalog of shadows in the 1/4 keV soft X-ray diffuse background 4 (SXRB) that were identified by a comparison between ROSAT All-Sky Survey maps and DIRB&corrected IRAS 100 micron maps. These "shadows" are the negative correlations between the surface brightness of the SXRB and the column density of the Galactic interstellar medium (ISIM) over limited angular regions (a few degrees in extent). We have compiled an extensive but not exhaustive set of 378 shadows in the polar regions of the Galaxy (Absolute value (beta) is greater than and approximately equal 20 deg.), and determined their foreground and background X-ray intensities (relative to the absorbing features), and the respective hardness ratios of that emission. The portion of the sky that was examined to find these shadows was restricted in general to regions where the minimum column density is less than and approximately equal to 4 x 10(exp 20) H/square cm, i.e., relatively high Galactic latitudes, and to regions away from distinct extended features in the SXRB such as supernova remnants and superbubbles. The results for the foreground intensities agree well with the recent results of a general analysis of the local 1/4 KeV emission while the background intensities show additional. but not unexpected scatter. The results also confirm the existence of a gradient in the hardness of the local 1/4 keV emission along a Galactic center/ anticenter axis with a temperature that varies from 10(exp 6.13) K to 10(exp 6.02) K, respectively. The average temperature of the foreground component from this analysis is 10(exp 6.08) K, compared to 10(exp 6.06) K in the previous analysis. Likewise, the average temperature for the distant component for the current and previous analyses are 10(exp 6.06) K and 10(exp 6.02) K, respectively. Finally, the results for the 1/4 keV halo emission are compared to the observed fluxes at 3/4 keV, where the lack of correlation suggests that the Galactic halo's 1/4 keV and 3/4 keV fluxes are likely produced by separate emission regions.
Author
Background Radiation; Galactic Halos; Interstellar Matter; Shadows

20000073240 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Infrared Submillimeter and Radio Astronomy Research and Analysis Program *Final Report, 1 Dec. 1997 - 31 May 2000*

Traub, Wesley A., Smithsonian Astrophysical Observatory, USA; June 2000; 22p; In English

Contract(s)/Grant(s): NCC2-1012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This program entitled "Infrared Submillimeter and Radio Astronomy Research and Analysis Program" with NASA-Ames Research Center (ARC) was proposed by the Smithsonian Astrophysical Observatory (SAO) to cover three years. Due to funding constraints only the first year installment of $18,436 was funded, but this funding was spread out over two years to try to maximize the benefit to the program. During the tenure of this contact, the investigators at the SAO, Drs. Wesley A. Traub and Nathaniel P. Carleton, worked with the investigators at ARC, Drs. Jesse Bregman and Fred Wittebom, on the following three main areas: 1. Rapid scanning SAO and ARC collaborated on purchasing and constructing a Rapid Scan Platform for the delay arm of the Infrared-Optical Telescope Array (IOTA) interferometer on Mt. Hopkins, Arizona. The Rapid Scan Platform was tested and improved by the addition of stiffening plates which eliminated a very small but noticeable bending of the metal platform at the micro-meter level. 2. Star tracking Bregman and Wittebom conducted a study of the IOTA CCD-based star tracker system, by constructing a device to simulate star motion having a specified frequency and amplitude of motion, and by examining the response of the tracker to this simulated star input. 3. Fringe tracking. ARC, and in particular Dr. Robert Mah, developed a fringe-packet tracking algorithm, based on data that Bregman and Witteborn obtained on IOTA. The algorithm was tested in the laboratory at ARC, and found to work well for both strong and weak fringes.

Derived from text

Algorithms; CCD Star Tracker; Infrared Astronomy; Interferometers; Star Trackers; Submillimeter Waves

20000073716 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Mid-Infrared Astronomy with the NGST

Serabyn, E., Jet Propulsion Lab., California Inst. of Tech., USA; Barsony, M., Jet Propulsion Lab., California Inst. of Tech., USA; Ressler, M., Jet Propulsion Lab., California Inst. of Tech., USA; Werner, M., Jet Propulsion Lab., California Inst. of Tech., USA; Armus, L., California Inst. of Tech., USA; Shupe, D., California Inst. of Tech., USA; Xu, C., California Inst. of Tech., USA; Backman, D., Franklin and Marshall Coll., USA; Ho, L., Carnegie Institution of Washington, USA; Koerner, D., Pennsylvania Univ., USA; [1998]; 1p; In English; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We present an overview of the science capabilities enabled by a mid-infrared camera/spectrometer on board the NGST. Even without full mid-IR optimization, a mid-infrared (5-30 microns) instrument on the NGST will be orders of magnitude more sensitive than any equivalent ground-based instrument/telescope combination. In the extragalactic arena, the mid-IR region is critical for a complete understanding of the or high-redshift universe, dusty star-formation regions at low and high redshifts, and starburst vs. AGN discrimination. In the local universe, great strides forward can be made using mid-IR imaging, spectroscopy, and coronagraphy of dusty and rocky disks of all ages, from protostellar to remnant debris disks. Near-neighbor detection and characterization can also be greatly advanced by mid-infrared observations.

Author

Infrared Radiation; Infrared Sources (Astronomy); Infrared Astronomy; Cameras; Spectrometers; Next Generation Space Telescope Project; Infrared Telescopes

20000073720 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

VSOP Monitoring of the Quasar 1928+738

Murphy, D. W., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; Very High Resolution Imaging in VLBI, 13-21 Aug. 1999, Toronto, Canada; Sponsored by International Scientific Radio Union, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

One limitation of the VSOP (VLBI Space Observatory Program) mission is that several famous superluminal sources such as 3C273 cannot be monitored with good uv-coverage throughout the lifetime of the VSOP Mission at regular intervals that are spaced closely enough to follow the evolution in the fine-scale source-structure. The reason for this is that the HALCA spacecraft cannot#observe sources outside certain restricted ranges of sun angle, defined to be the time variable angle between the source and the sun. However sources that lie within 10 degrees of the ecliptic poles can be observed throughout the year and observations are not restricted to narrow temporal windows. Furthermore, the best ground-based uv-coverages are obtained for circumpolar sources and consequently these will be the sources for which the maximum amount of space VLBI data will be obtained with a given ground array. We have began a VSOP monitoring campaign at 5 GHz on the relatively low redshift (z=0.3) superluminal quasar 1928+738 which is both a circumpolar source and lies 10 degrees away from the ecliptic pole. 1928+738 is in the S5 polar cap sample and has been well studied both on the arsecond-scale and mas-scale. 22 GHz observations have shown that the motion

of the VLBI components in 1928+738 is inconsistent with simple linear expansion along a fixed position angle (PA) for all components. Indeed, 1928+738 was one of the first sources for which helical jet motion was proposed and it has been further proposed that a massive binary black hole (MBBH) system is responsible for the sinusoidal jet ridge line observed at 22 GHz over a S year period. our VSOP observations are designed to check this proposal.

Author

Very Long Base Interferometry; Observatories; Space Programs; Quasars

20000074056 Oxford Univ., Physics Dept., Oxford, UK

Infrared Photometry of Z approximately 1 3C Quasars

Simpson, Chris, National Astronomical Observatory of Japan, USA; Rawlings, Steve, Oxford Univ., UK; 2000; 10p; In English; Copyright; Avail: Issuing Activity

We present JHKL' photometry of a complete sample of steep-spectrum radio-loud quasars from the revised 3CR catalogue in the redshift range 0.65 is less than /= z is less than 1.20. After correcting for contributions from emission lines and the host galaxies, we investigate their spectral energy distributions (SEDS) around l micron. About 75% of the quasars are tightly grouped in the plane of optical spectral index, alpha(sub opt), versus near-infrared spectral index, alpha(sub IR), With the median value of alpha(sub opt) close to the canonical value, and the median alpha(sub IR) slightly flatter. We conclude that the fraction of moderately-obscured, red quasars decreases with increasing radio power, in accordance with the 'receding torus' model which can also explain the relatively flat median near-infrared spectra of the 3CR quasars. Two of the red quasars have inverted infrared spectral indices, and we suggest that their unusual SEDs might result from a combination of dust-scattered and transmitted quasar light.

Author

Quasars; Active Galaxies; Infrared Astronomy; Near Infrared Radiation; Spectral Energy Distribution

20000074084 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Searching for Extrasolar Planets with SIM

Unwin, Stephen C., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The Space Interferometry Mission (SIM) will be the first spacebased long base-line Michelson interferometer designed for precision astrometry. SIM will extend the reach of astrometry to cover the entire Galaxy, and will address a wide range of problems in Galactic structure and stellar astrophysics. It will also serve as a technology precursor for future astrophysics missions using interferometers. SIM will be a powerful tool for discovering planets around nearby stars, through detection of the reflex motion, and it will directly measure masses for the planets detected this way. It will have a single-measurement precision of 1 microarcsecond in a frame defined by nearby reference stars, enabling SIM to search for planets with masses as small as a few earth masses around the nearest star. More massive planets will be detectable to much larger distances.

Author

Exploration; Extrasolar Planets; Galactic Structure; Michelson Interferometers

20000074099 NASA Marshall Space Flight Center, Huntsville, AL USA

Lingering Problems in Gamma-Ray Observations of GRBs

Meegan, Charles A., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Marcel Grossman Meeting, 2 Jul. 2000, Rome, Italy; No Copyright; Avail: Issuing Activity; Abstract Only

Although observations of Gamma Ray Bursts (GRBs) in other wavelengths have transformed the field, the gamma-ray region of the spectrum remains important. This talk will summarize a number of unresolved issues specific to gamma-ray observations. For example, the apparent narrowness of the distribution of peak energy is difficult to explain either as an intrinsic characteristic of bursts or as a selection effect. There have also been controversial claims for anisotropy in subgroups of bursts.

Author

Gamma Ray Bursts; Gamma Ray Astronomy

20000074101 NASA Marshall Space Flight Center, Huntsville, AL USA

The Chandra X-Ray Observatory Overview

Weisskopf, Martin C., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 4-8 Jun. 2000, Rochester, NY, USA;

The Chandra X-Ray Observatory was launched early in the morning of July 23, 1999 by the Space Shuttle Columbia. The Shuttle launch was only the first step in placing NASA's latest great observatory into orbit. After release from the cargo bay, the Inertial Upper Stage performed two firings and separated from the observatory as planned. Finally, after five firings of Chandra's own Integral Propulsion System - the last of which took place 15 days after the initial launch - the observatory was placed in its highly elliptical orbit of 140,000 km apogee and 10,000 km perigee. After Observatory activation, the first x-rays focused by the telescope were observed on August 12, 1999. Beginning with this initial observation one could conclude that the telescope had survived the launch environment and was operating as expected. The month following the opening of the sunshade door was spent adjusting the focus for each set of instrument configurations, determining the optical axis, calibrating the star camera, establishing the relative response functions, determining the energy scale(s), and performing a series of "publicity" images. Each observation proved to be far more revealing than was expected. Preliminary results will be presented and the status of the instrumentation on the observatory will be discussed.
Author

X Ray Astrophysics Facility; X Ray Astronomy; Spaceborne Astronomy

20000074104 NASA Marshall Space Flight Center, Huntsville, AL USA

A Search for CMB Decrements Towards Distant Cluster Candidates PC 1643+4631 and VLA 1312+4237 at 28.5 GHz

Holzapfel, W. L., NASA Marshall Space Flight Center, USA; Carlstrom, J. E., NASA Marshall Space Flight Center, USA; Grego, L., NASA Marshall Space Flight Center, USA; Reese, E. D., NASA Marshall Space Flight Center, USA; Joy, M., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Recently, Jones et al. used the Ryle telescope, operating at a frequency of 15 GHz, to detect a flux decrement in the direction of the quasar pair PC 1643+461A,B. They interpreted this signal as the Sunyaev-Zel'dovich effect (SZE) produced by a distant cluster of galaxies. In the course of an effort to measure CMB anisotropies using the VLA at 8.4 GHz, Richards et al. (1997) detected a similar, but smaller, decrement which we refer to as VLA 1312+4237. They also proposed that this signal might be explained as the SZE signal of a distant galaxy cluster. We report observations in the direction of these claimed sources with the Berkeley Illinois Maryland Association (BIMA) interferometer operating at 28.5 GHz. We find no evidence for SZE emission in the direction of either of the claimed sources. In the case of PC 1643+4631, the BIMA data are inconsistent with the cluster emission model proposed by Jones et al. at greater than 99.99% confidence. Together with published x-ray and optical searches, these results make a compelling case against the existence of a massive cluster in the direction of PC 1643+4631. Because of the different scales to which the VLA and BIMA instruments are sensitive, the BIMA observations are not as constraining for the VLA 1312+4237 source. The BIMA data are inconsistent with the cluster model proposed by Richards et al. (1997) at approximately 80% confidence.
Author

Galactic Clusters; Cosmic Noise

20000074107 Smithsonian Astrophysical Observatory, Cambridge, MA USA

Chandra Observations of M31 and their Implications for its ISM

Primini, F., Smithsonian Astrophysical Observatory, USA; Garcia, M., Smithsonian Astrophysical Observatory, USA; Murray, S., Smithsonian Astrophysical Observatory, USA; Forman, W., Smithsonian Astrophysical Observatory, USA; Jones, C., Smithsonian Astrophysical Observatory, USA; McClintock, J., Smithsonian Astrophysical Observatory, USA; Apr. 07, 2000; 1p; In English; Interstellar Medium in M31 and M33 Workshop, 20-25 May 2000, Bad Honnef, Germany
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As part of the Chandra X-ray Observatory's Survey/Monitoring Program of M31, we have been regularly observing the bulge amd inner disk of M31 for nearly 1 year, using both the HRC and ACIS Instruments. We present results from our program th it are of interest to the study of the ISM in M31. In particular, spectral analysis of bright, unresolved x-ray sources in the bulge reveals the presence of significant local x-ray extinction (N(sub H) is about 2 x 10(exp 21)/square cm), and we will attempt to map out this extinction, Further, we find that diffuse emission accounts for a significant fraction of the overall x-ray flux from the bulge. Finally, our search for x-ray counterparts to supernova remnants in M31 yields surprisingly few candidates.
Author

Andromeda Galaxy; X Ray Sources; Interstellar Matter; X Ray Astronomy; Supernova Remnants

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20000069035 Aerospace Corp., EL Segundo Technical Operations, El Segundo, CA USA
The Impact of the Space Environment on Space Systems
Koons, H. C.; Mazur, J. E.; Selesnick, R. S.; Blake, J. B.; Fennell, J. F.; Jul. 20, 1999; 202p; In English
Contract(s)/Grant(s): F04701-93-C-0094
Report No.(s): AD-A376872; TR-99(1670)-1; SMC-TR-00-10; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche
    We have undertaken a study to determine the impact of the space environment on space systems. Known impacts include mission outages, mission degradation and mission failure, launch delays, redesign and retest, anomaly analyses, and the ultimate cost for each of the preceding. We are attempting to quantify these impacts whenever possible. This task is made difficult because impacts are rarely formally documented. We reviewed a variety of sources for anomaly impact information. These sources include anomaly reports from the archives of the Space Sciences Department of The Aerospace Corporation and other organizations, written and oral information from other staff members of The Aerospace Corporation, and contractor reports and published documents relating to spacecraft anomalies. The study provides a good indication of the quality and quantity of the data available. It also shows the degree to which it is possible to obtain impact information for historical anomalies. We summarize the results of the study, and emphasize those causes for which it may be possible to provide predictive information such as surface charging, internal charging, and the single-event upsets that accompany solar proton events.
DTIC
Aerospace Environments; Aerospace Systems; Degradation; Impact

20000069800 NASA Ames Research Center, Moffett Field, CA USA
Laboratory Astrophysics in Solar System Studies: An Overview
Cruikshank , D. P., NASA Ames Research Center, USA; [1998]; 31p; In English
Contract(s)/Grant(s): RTOP 344-32-20-01; Copyright; Avail: Issuing Activity
    The compositions of the numerous bodies in the Solar System are determined from remote sensing observations, most often spectroscopic, and in some cases direct sampling. Laboratory studies of materials and processes are an essential component of the analysis and interpretation of all compositional data. Planetary atmospheres are composed of gases and aerosols, while the surfaces of the terrestrial planets, asteroids, comets, and planetary satellites are composed of minerals, ices, and organic solids. The principal spectroscopic characteristics of each of these materials are reviewed here. The tables present a synopsis of our current knowledge of the compositions of the principal bodies in the Solar System.
Author
Astrophysics; Solar System; Remote Sensing; Planetary Atmospheres; Composition (Property); Planetary Surfaces

20000070449 Hertfordshire Univ., Hatfield, UK
Circumnuclear Regions In Barred Spiral Galaxies, 1, Near-Infrared Imaging
Perez–Ramirez, D., Hertfordshire Univ., UK; Knapen, J. H., Hertfordshire Univ., UK; Peletier, R. F., Durham Univ., UK; Laine, S., Hertfordshire Univ., UK; Doyon, R., Observatoire du Mont Megantic, Canada; Nadeau, D., Observatoire du Mont Megantic, Canada; Apr. 06, 2000; 20p; In English
Contract(s)/Grant(s): NAS5-26555; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    We present sub-arcsecond resolution ground-based near-infrared images of the central regions of a sample of twelve barred galaxies with circumnuclear star formation activity, which is organized in ring-like regions typically one kiloparsec in diameter. We also present Hubble Space Telescope near-infrared images of ten of our sample galaxies, and compare them with our ground-based data. Although our sample galaxies were selected for the presence of circumnuclear star formation activity, our broad-band near-infrared images are heterogeneous, showing a substantial amount of small-scale structure in some galaxies, and practically none in others. We argue that, where it exists, this structure is caused by young stars, which also cause the characteristic bumps or changes in slope in the radial profiles of ellipticity, major axis position angle, surface brightness and colour at the radius of the circumnuclear ring in most of our sample galaxies. In 7 out of 10 HST images, star formation in the nuclear ring is clearly visible as a large number of small emitting regions, organised into spiral arm fragments, which are accompanied by dust lanes. NIR colour index maps show much more clearly the location of dust lanes and, in certain cases, regions of star formation than single broad-band images. Circumnuclear spiral structure thus outlined appears to be common in barred spiral galaxies with circumnuclear star formation.
Author
Barred Galaxies; Star Formation; Galactic Structure; Active Galactic Nuclei; Infrared Imagery

Hertfordshire Univ., Dept. of Physical Sciences, Hatfield, UK

Deficiency of "Thin" Stellar Bars in Seyfert Host Galaxies

Shlosman, Isaac, Kentucky Univ., USA; Peltier, Reynier F., Nottingham Univ., UK; Knapen, Johan, Isaac Newton Group, Spain; [1999]; 10p; In English

Contract(s)/Grant(s): NAGW-3841; WKU-522762-98-06; HST AR-07982.01-96A; GO-08123.01-97A; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Using all available major samples of Seyfert galaxies and their corresponding control samples of closely matched non-active galaxies, we find that the bar ellipticities (or axial ratios) in Seyfert galaxies are systematically different from those in non-active galaxies. Overall, there is a deficiency of bars with large ellipticities (i.e., 'fat' or 'weak' bars) in Seyferts, compared to non-active galaxies. Accompanied with a large dispersion due to small number statistics, this effect is strictly speaking at the 2 sigma level. to obtain this result, the active galaxy samples of near-infrared surface photometry were matched to those of normal galaxies in type, host galaxy ellipticity, absolute magnitude, and, to some extent, in redshift. We discuss possible theoretical explanations of this phenomenon within the framework of galactic evolution, and, in particular, of radial gas redistribution in barred galaxies. Our conclusions provide further evidence that Seyfert hosts differ systematically from their non-active counterparts on scales of a few kpc.
Author

Seyfert Galaxies; Ellipticity; Stellar Atmospheres; Galactic Evolution

Lunar and Planetary Inst., Houston, TX USA

Workshop on Extraterrestrial Materials from Cold and Hot Deserts

Schultz, Ludolf, Editor, Lunar and Planetary Inst., USA; Franchi, Ian A., Editor, Lunar and Planetary Inst., USA; Reid, Arch M., Editor, Lunar and Planetary Inst., USA; Zolensky, Michael E., Editor, Lunar and Planetary Inst., USA; 2000; 114p; In English; Extraterrestrial Materials from Cold and Hot Deserts, 6-8 Jul. 1999, Kawa-Maritane, South Africa; Sponsored by Lunar and Planetary Inst., USA; See also 20000070518 through 20000070544

Contract(s)/Grant(s): NASW-4574

Report No.(s): LPI-Contrib-997; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Since 1969 expeditions from Japan, the USA, and European countries have recovered more than 20,000 meteorite specimens from remote ice fields of Antarctica. They represent approximately 4000-6000 distinct falls, more than all non-Antarctic meteorite falls and finds combined. Recently many meteorite specimens of a new "population" have become available: meteorites from hot deserts. It turned out that suitable surfaces in hot deserts, like the Sahara in Africa, the Nullarbor Plain in Western and South Australia, or desert high plains of the U.S. (e.g., Roosevelt County, New Mexico), contain relatively high meteorite concentrations. For example, the 1985 Catalogue of Meteorites of the British Museum lists 20 meteorites from Algeria and Libya. Today, 1246 meteorites finds from these two countries have been published in MetBase 4.0. Four workshops in 1982, 1985, 1988, and 1989 have discussed the connections between Antarctic glaciology and Antarctic meteorites, and the differences between Antarctic meteorites and modem falls. In 1995, a workshop addressed differences between meteorites from Antarctica, hot deserts, and modem falls, and the implications of possible different parent populations, infall rates, and weathering processes. Since 1995 many more meteorites have been recovered from new areas of Antarctica and hot deserts around the world. Among these finds are several unusual and interesting specimens like lunar meteorites or SNCs of probable martian origin. The Annual Meeting of the Meteoritical Society took place in 1999 in Johannesburg, South Africa. As most of the recent desert finds originate from the Sahara, a special workshop was planned prior to this meeting in Africa. Topics discussed included micrometeorites, which have been collected in polar regions as well as directly in the upper atmosphere. The title "Workshop on Extraterrestrial Materials from Cold and Hot Deserts" was chosen and the following points were emphasized: (1) weathering processes, (2) terrestrial ages, (3) investigations of "unusual" meteorites, and (4) collection and curation.
Derived from text

Meteorites; Antarctic Regions; Deserts; Glaciology

Arkansas Univ., Cosmochemistry Group, Fayetteville, AR USA

The Natural Thermoluminescence Survey of Antarctic Meteorites: Ordinary Chondrites at the Grosvenor Mountains, MacAlpine Hills, Pecora Escarpment and Queen Alexandra Range, and New Data New Data for the Elephant Moraine, Ice Fields

Benoit, Paul H., Arkansas Univ., USA; Sears, Derek W. G., Arkansas Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 11-14; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The natural TL survey of Antarctic meteorites was started in 1987 at the request of the Antarctic Meteorite Working Group in order to provide an initial description of radiation and thermal histories. It was intended to be a complement to the mineralogical

and petrographic surveys performed at the Johnson Space Center and the Smithsonian Institution. All ANSMET samples recovered since then, besides those that were heated throughout by atmospheric passage, have been measured. to date this amounts to about 1200 samples. As the data for each ice field reaches a significant level, we have been conducting a thorough examination of the data for that field with a view to (1) identifying pairing, (2) providing an estimate of terrestrial age and residence time on the ice surface, (3) looking for differences in natural TL between ice fields, (4) looking for variations in natural TL level with location on the ice, (5) looking for meteorites with natural TL levels outside the normal range. Pairing is a necessary first step in ensuring the @ost productive use of the collection, while geographical variations could perhaps provide clues to concentration mechanisms. Samples with natural TL values outside the normal range are usually inferred to have had either small perihelia or recent changes in orbital elements. In addition, induced TL data have enabled us to (5) look for evidence for secular variation in the nature of the flux of meteorites to Earth, and (6) look for petrologically unusual meteorites, such as particularly primitive ordinary chondrites, heavily shocked meteorites, or otherwise anomalous meteorites. to date we have published studies of the TL properties of 167 ordinary chondrites from Allan Hills, 107 from Elephant Moraine and 302 from Lewis Cliff and we have discussed the TL properties of fifteen H chondrites collected at the Allan Hills by Euromet after a storm during the 1988 season. We now have additional databases for a reasonable number of ordinary chondrites from Grosvenor Mountains (39 meteorites), MacAlpine Hills (70 meteorites), Pecora Escarpment (60 meteorites), and Queen Alexandra Range (173 meteorites) and we have data for a further 101 samples from Elephant Moraine. The results are summarized in Table 1. We also have fairly minimal databases (10-15 meteorites) for Dominion Range, Graves Nunataks, Reckling Peak and Wisconsin Range that will not be discussed here.
Derived from text

Thermoluminescence; Antarctic Regions; Meteorites; Mountains; Surveys

Meteorites from the Nullarbor, Australia: An Update
Bevan, A. W. R., Western Australian Museum of Natural Science, Australia; Bland, P. A., Museum of Natural History, UK; Jull, A. J. T., Arizona Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 15-16; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Available from CASI only as part of the entire parent document; Abstract Only; Available from CASI only as part of the entire parent document

The gibber plains of the Nullarbor in Australia are important meteorite accumulation sites. Situated on the border between Western Australia and South Australia, the Nullarbor consists of flat-lying limestones of Early Miocene age exposed over a total area of ca. 240,000 sq km and covered with a thin calcareous loam. Prolonged aridity has allowed the accumulation of meteorites in the region, and a physiographically stable surface over the last 30 ka combined with low weathering rates are model circumstances for the estimation of the meteorite flux with time. Moreover, quantification of weathering effects in ordinary chondrites from the Nullarbor is providing a new palaeoclimatic tool. Similar to Antarctica, the masses of most stony meteorites from the Nullarbor are 100 g or less, with a peak in the mass distribution between 10-50 g. Statistical analysis of meteorite types from the Nullarbor shows that stony meteorites are most abundant with chondrites accounting for 92.7% of the total. Only 1.5% of distinct meteorites so far described from the Nullarbor are irons, which is much less than that (ca. 5%) predicted from the modem flux of meteorites. The small number of distinct irons from the Nullarbor is difficult to explain and human interference cannot be ruled out. Nevertheless, out of the four irons known, three, Mundrabilla, Haig, and Watson make up more than 99% of the total mass of meteorites collected from the Nullarbor.
Derived from text

Meteorites; Chondrites; Australia; Stony Meteorites; Meteoroid Concentration; Paleoclimatology; Mass Distribution

Ice Flow as the Principal Sink for Antarctic Meteorites
Bland, P. A., Museum of Natural History, UK; Jull, A. J. T., Arizona Univ., USA; Bevan, W. R., Western Australian Museum, Australia; Smith, T. B., Open Univ., UK; Berry, F. J., Open Univ., UK; Pillinger, C. T., Open Univ., UK; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 17-20; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

It has previously been shown that Mossbauer spectroscopy is capable of providing a quantitative measure of weathering in ordinary chondrite (OC) meteorites. Used in conjunction with C-14 terrestrial ages, we have used this method to constrain weathering rates for individual hot desert meteorite populations. Typically, oxidation over time may be effectively modelled using an appropriate power-law, suggesting an initial rapid weathering phase, followed by more gradual oxidation. by quantifying oxidation over time, and modelling the effect of oxidation in destroying samples (from oxidation-frequency distributions) we can derive a decay-rate for meteorites in an accumulation, or a weathering half-life of a meteorite in a population. This, combined with a knowledge of the number of individual meteorites on the ground today, enables an estimate of the flux of meteorites over the life-

time of the site. Hot desert OC's typically show a peak in their oxidation-frequency distribution at 40% (ie. 40% of the iron in a meteorite is ferric): until this point oxidation is accommodated by available porosity; after this point porosity is exceeded and the sample erodes. If this interpretation is correct, the oxidation-frequency distribution describes the response of OC's to a given amount of chemical weathering, and should be similar between different sites. Ordinary chondrites at the Allan Hills, despite their far longer residence times, are found to have a peak in there oxidation-frequency distribution at 10-15%. 25-30% lower than hot desert OC's. In addition (and contrary to earlier studies, although the data show more scatter than is typical of hot desert populations, we have shown that there is a correlation between weathering and terrestrial age for the Allan Hills meteorites, allowing an (approximate) estimate of the rate of weathering over time. The plot of oxidation over time, although indicating much slower weathering rates than for hot desert meteorites, is qualitatively similar in its form: it can be modelled using an appropriate power-law, and shows an initial rapid weathering phase.

Derived from text

Ice; Antarctic Regions; Meteorites; Chondrites; Carbon 14; Frequency Distribution

20000070521 NASA Johnson Space Center, Houston, TX USA

Pairing Among the EET87503 Group of Howardites and Polymict Eucrites

Buchanan, P. C., NASA Johnson Space Center, USA; Lindstrom, D. J., NASA Johnson Space Center, USA; Mittlefehldt, D. W., Lockheed Martin Space Operations, USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 21-24; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The ten HED polymict breccias EET82600, EET87503, EET87509, EET87510, EET87512, EET87513, EET87518, EET87528, EET87531, and EET92022 were found over a broad area in the Elephant Moraine collecting region of Antarctica. Locations are scattered among the Main (Elephant Moraine), Meteorite City, and Texas Bowl icefields and the Northern Ice Patch. It was previously suggested that these polymict breccias are paired. However, degree of terrestrial alteration among these meteorites varies from relatively pristine (type A) to extensively altered (type B/C) and there are textural, mineralogical, and compositional differences. This study is a reevaluation of the pairing of these meteorites.

Derived from text

Meteorites; Breccia; Meteoritic Composition; Mineralogy; Achondrites

20000070522 Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA

Chemical Alteration of Hot Desert Meteorites: The Case of Shergottite Dar Al Gani 476

Crozaz, Ghislaine, Washington Univ., USA; Wadhwa, Meenakshi, Field Museum of Natural History, USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 25-27; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

During the last three decades, many cosmochemical studies have been stimulated by the recovery of large numbers of meteorites from Antarctica. Similarly, the more recent discoveries of meteorites in hot deserts significantly increase the number of known meteorites. It is likely that new meteorite types will be found in these hot deserts and that the number of rare meteorites that can be studied in the laboratory using an array of state of the art techniques will be expanded. However, meteorites found in both cold and hot deserts have much longer terrestrial ages than others and, thus, it is critical to ascertain whether their properties reflect processes that occurred prior to their fall on earth or whether some of their characteristics have been modified by their extensive residence on our planet. Here, we study the microdistribution of lanthanides (REE) and use them as indicators of terrestrial alteration. These elements are important because they are commonly used to decipher the petrogenesis and chronology of meteorites.

Derived from text

Meteorites; Shergottites; Chemical Effects; Deserts

20000070523 State Univ. of New York, Dept. of Physics, Plattsburgh, NY USA

Chemical Compositions of Large Interplanetary Dust Particles From the Stratosphere and Small Antarctic Micrometeorites: Evidence for Element Loss and Addition in the Antarctic Micrometeorites

Flynn, G. J., State Univ. of New York, USA; Sutton, S. R., Chicago Univ., USA; Kloeck, W., Martin Luther-Univ., German Democratic Republic; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 28-32; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The largest interplanetary dust particles (IDPs) collected from the Earth's stratosphere overlap in size with the smallest micrometeorites collected from the polar ices. This size overlap, for particles from about 25 to 75 microns in diameter, offers the opportunity to compare particles that were, presumably, identical prior to their respective terrestrial residence, collection, and curation. Differences between the IDPs and the polar micrometeorites are likely to result from contamination or weathering in the respective environments of each particle. This size range from 25 to 75 microns is particularly interesting because the mass-frequency

distribution for particles incident on the Earth's atmosphere is sharply peaked in the 10(exp -6) to 10(exp -5) gram mass range (particles a few hundred microns in diameter). Thus, the 25 to 75 micron diameter IDPs and polar micrometeorites are close in size to the peak in the mass-frequency distribution, and these particles are likely to reflect the composition of the bulk of the interplanetary material accreting onto the Earth.
Derived from text
Micrometeorites; Chemical Composition; Interplanetary Dust; Mass Distribution; Size Distribution

20000070524 Open Univ., Planetary Sciences Research Inst., Milton Keynes, UK
The Influence of Terrestrial Weathering on Implanted Solar Gases in Lunar Meteorites
Franchi, I. A., Open Univ., UK; Verchovsky, A. V., Open Univ., UK; Pillinger, C. T., Open Univ., UK; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 33-35; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The recent discovery of two large lunar meteorites in the Dar al Gani (DaG) region of the Libyan Sahara desert (DaG 262 and DaG 400) have sparked considerable and wide ranging interest in lunar material. The addition of lunar meteorites to the collections of extraterrestrial material have greatly complemented the suite of samples returned by the Apollo and Luna missions almost 30 years ago, extending the range of materials available for investigation. However, care may be required in interpreting variations seen in the lunar meteorite population and also any differences with the returned lunar samples. As has been noted previously in the comparison of ordinary chondrite populations from Antarctica, hot deserts and observed falls, variations between the populations may be attributed to their interaction with the different terrestrial environments they have been exposed to rather than indigenous, pre-atmospheric differences. In the case of the lunar samples this effect may be even more extreme as all the lunar meteorites are finds whereas the returned lunar samples were collected and subsequently stored in as near to ideal conditions as practically possible. Other factors related to the high levels of radiation damage suffered by materials in the lunar regolith may also make certain aspects of the lunar meteorites susceptible to terrestrial weathering. The particular interest behind this paper is how terrestrial weathering may have influenced the abundance and release characteristics of the implanted solar gases.
Derived from text
Meteorites; Lunar Rocks; Meteoritic Composition; Weathering; Radiation Damage

20000070525 Museum of Natural History, Dept. of Mineralogy, London, UK
Meteorites from Cold and Hot Deserts: How Many, How Big, and What Sort?
Grady, Monica M., Museum of Natural History, UK; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 36-40; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In the 5 years since the first workshop on meteorites from cold and hot deserts, there has been a big rise in the number of meteorites returned from desert localities. The number of meteorites found in the Sahara has grown three-fold, several new Antarctic localities have yielded plentiful harvests (e.g. Grosvenor Mountains, Queen Alexandra Range), and return visits to well-documented Antarctic sites have also resulted in many additional meteorites (e.g. Elephant Moraine). Although classification of new meteorites is regularly reported in the Meteoritical Bulletin, the total number of different types from all localities has not been published for many years. The present Symposium provides an opportunity to draw together statistical data for meteorites from cold and hot deserts, for comparison with data for modem falls; data are taken from the (almost published) 5th Edition of the Catalogue of Meteorites. All numbers are correct as of 1st May 1999.
Derived from text
Meteorites; Deserts; Antarctic Regions; Glacial Drift

20000070526 Arizona Univ., NSF Arizona Accelerator Mass Spectrometer Facility, Tucson, AZ USA
Using C-14 and C-14 - Be-10 for Terrestrial Ages of Desert Meteorites
Jull, A. J. T., Arizona Univ., USA; Bland, P. A., Museum of Natural History, UK; Klandrud, S. E., Arizona Univ., USA; McHargue, L. R., Arizona Univ., USA; Bevan, A. W. R., Western Australian Museum, Australia; Kring, D. A., Arizona Univ., USA; Wlotzka, F., Max-Planck-Inst. fuer Chemie, Germany; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 41-43; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The arid regions of the world appear to be great storage locations for meteorites, where they can survive for long periods of time in such environments. Large numbers of meteorites have been recovered from diverse areas of and and semi-arid regions of North Africa, Arabia, North America and Western Australia. The cold desert of Antarctica is a further storehouse of meteorites.

One of the first recognized areas for collections of meteorites was Roosevelt County, New Mexico. The Nullarbor region of Australia and the northern Sahara Desert in Africa are also prolific sources of meteorites.
Derived from text
Arid Lands; Meteorites; Carbon 14; Beryllium Isotopes

20000070527 Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA
The Gold Basin Strewn Field, Mojave Desert, and its Survival from The Late Pleistocene to the Present
Kring, David A., Arizona Univ., USA; Jull, A. J. Timothy, Arizona Univ., USA; Bland, Phil A., Museum of Natural History, UK; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 44-45; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Gold Basin strewn field occurs in the Mojave Desert of northwestern Arizona. When we first reported the find last year, approximately 2000 specimens had been recovered over a 160 sq km area. More recent fieldwork has increased the number of samples to approx. 3000 over an area of about 225 sq km. The area is currently part of the arid American Southwest, but climatic conditions have fluctuated since the time the meteorite fell. In this paper, we explore those changes and how they affected the weathering of the meteorite, comparing and contrasting these effects, where possible, with the effects seen among meteorites found in other hot desert regions of the world.
Derived from text
Mojave Desert (CA); Climatology; Arid Lands; Meteorites

20000070528 Purdue Univ., Dept. of Chemistry, West Lafayette, IN USA
Thermally Mobile Trace Elements in Carbonaceous Chondrites From Cold and Hot Deserts
Lipschutz, M. E., Purdue Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 46-47; In English; See also 20000070517
Contract(s)/Grant(s): DE-FG02-95NE-38135; NAGW-3396; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Some decades ago, Anders and co-workers used RNAA to classify a number of trace elements as being volatile during nebular condensation and accretion into primitive objects based upon their strong depletion in (equilibrated) ordinary chondrites relative to C1 chondrites. Such elements, e.g. Ag, Bi, Cd, Cs, In, Se, Te, Tl, Zn and others, exhibit nearly constant, C1-normalized atomic abundances in C2 (CM2) and in C3 chondrites. They interpreted the near-constancy of these abundances according to a 2-component model in which volatiles were introduced into carbonaceous (and other) chondrites as C1 material which was diluted with differing proportions of high-temperature (i.e. volatile-free) components. In this view, mean volatile element abundances of 0.48 in C2 and 0.24-0.29 x C1 in C3 chondrites indicated that C2 and C3 chondrites are, respectively, about 1:1 and 1:2-3 mixtures of C1-like and high temperature materials. More recently, Xiao and Lipschutz found that C-normalized abundances of such volatile elements are nearly constant in most C2-6 chondrites (i.e. 25 non-Antarctic meteorites, nearly all falls, and 36 Antarctic finds) consistent with a 2-component mixing model. However, rather than being quantized, mean volatile element contents in each chondrite define a continuum from 0.92-0.14 x C1 for these 61 chondrites. A few carbonaceous chondrites, the first having been the NIPR consortium samples B-7904, Y-82162 and Y-86720, show an altered pattern: many of the volatile elements in each exhibit the usual constancy of C1-normalized atomic abundances, but modified by further depletion of Cd and other elements like Tl and Bi. These are the most mobile trace elements, i.e. those most readily vaporized and lost from primitive meteorites during week-long heating at greater than or equal to 400 C under low ambient pressures (initially 10(exp -5) atm H2), simulating metamorphic conditions in a primitive parent body. Similarities between mobile element data for B-7904, Y-82162 and Y-86720 with those for Murchison heated at 500-700 C, suggest that these Antarctic C1 - and C2-like chondrites were metamorphosed at temperatures like these in the interiors of their parent bodies. Metamorphic temperatures inferred from RNAA data and textural/mineralogic alterations are internally consistent, agreeing., with those evident in heated Murchison samples. These 3 chondrites were also heated late in their histories since all have lost cosmogenic He-3, presumably during close solar approach, and B-7904 and Y-86720 seem also to have lost substantial proportions of radiogenic He-4 and Ar-40 cf. data in. Similarities in spectral reflectance data for C-, G-, B- and F- asteroids, for these meteorites and for heated Murchison samples suggest that thermally metamorphosed interior materials in these asteroids were excavated by impacts and re-deposited on them, forming their present surfaces. Establishment of the thermal metamorphic histories of carbonaceous chondrites, then, is essential to establishing the evolution and present-day nature of C-type and related asteroids.
Derived from text
Trace Elements; Carbonaceous Chondrites; Deserts; Metamorphism (Geology); Meteorites; Helium Isotopes; Cosmology; Asteroids; Argon Isotopes

20000070529 Harvard-Smithsonian Center for Astrophysics, Cambridge, MA USA

Historical Notes on Three Exceptional Iron Meteorites of Southern Africa: The Cape of Good Hope, Gibeon, and Hoba

Marvin, Ursula B., Harvard-Smithsonian Center for Astrophysics, USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 48-52; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Africa, is among the richest of continents in meteorites from hot deserts. Namibia is the site of the world's largest individual meteorite, the 60-ton Hoba Ni-rich ataxite, and the largest known meteorite strewn field, that of the Gibeon fine octahedrite. In Egypt, history goes back at least as far as approx. 1340 B.C when an iron dagger with a small content of nickel was placed in the tomb of King Tutankhamen. History also comes up-to-date in northern Africa with recoveries in recent years of thousands of meteorites in the reaches of the Sahara from Libya to Mauretania. This paper will review the histories of three exceptional meteorites from southern Africa.

Author

Iron Meteorites; Africa; Histories; Nickel; Ataxite

20000070530 Max-Planck-Inst. fuer Chemie, Mainz, Germany

Saharan Meteorites with Short or Complex Exposure Histories

Merchel, S., Max-Planck-Inst. fuer Chemie, Germany; Altmaier, M., Cologne Univ., Germany; Faestermann, T., Technische Univ., Germany; Herpers, U., Cologne Univ., Germany; Knie, K., Technische Univ., Germany; Korschinek, G., Technische Univ., Germany; Kubik, P. W., Paul Scherrer Inst., Switzerland; Neumann, S., Technische Univ., Germany; Michel, R., Technische Univ., Germany; Suter, M., Eidgenoessische Technische Hochschule, Switzerland; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 53-56; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Long-lived radionuclides produced by cosmic rays in determine, on the one hand, the spectral distribution and the constancy of the cosmic ray flux and, on the other hand, to study the exposure history of the meteorites themselves. During the last four years we investigated a set of nearly one hundred meteorite samples with respect to cosmogenic radionuclides. Among them we found five meteorites from the Algerian and Libyan Sahara containing rather low radionuclide concentrations. to find out whether those reflect a short or a complex exposure time as meteoroids or "unusual" shielding conditions of the analysed sample, we decided to look at stable cosmogenic nuclides, too. Comparing the complete set of data to theoretical model calculations [2] offers the possibility to reveal the meteorite histories.

Derived from text

Meteorites; Cosmic Rays; Radioactive Isotopes; Low Concentrations; Meteoroids; Nuclides

20000070531 Physical Research Lab., Ahmedabad, India

Cosmogenic and Trapped Gas Components in the Martian Meteorite Dar Al Gani 476 From Hot Desert

Murty, S. V. S., Physical Research Lab., India; Mohapatra, R. K., Physical Research Lab., India; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 57-60; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Dar al Gani 476 is the first Martian meteorite to be identified from the Libyan Sahara. It mostly consists of pyroxenes, feldspathic glass, olivine, and also about a few percent of carbonate of certain terrestrial weathering origin. Based on the petrographic and chemical characteristics, it has recently been classified as a basaltic Shergottite. The meteorite appears highly fractured and shows effects of metamorphism under a shock pressure in the range of 40 to 50 GPa. A crystallization age of about 800 Ma, cosmic ray exposure age of 1.2 Ma and terrestrial age of is greater than 32 Ka are reported for DaG476. We received two subsamples, one from the surface (approx. 110 mg) and another from the interior (approx..500 mg) from Dr. Zipfel (MPIC, Mainz) for the investigation of cosmogenic records and trapped gas composition.

Derived from text

Gas Composition; Meteorites; Cosmic Rays; Cosmology; Shergottites; Carbonates

20000070532 California Univ., Space Sciences Lab., Berkeley, CA USA

Terrestrial Ages of Antarctic Meteorites: Up Date 1999

Nishiizumi, K., California Univ., USA; Caffee, M. W., Lawrence Livermore National Lab., USA; Welten, K. C., California Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 64; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche; Abstract Only; Available from CASI only as part of the entire parent document; Abstract Only; Available from CASI only as part of the entire parent document

We are continuing our ongoing study of cosmogenic nuclides in Antarctic meteorites. In addition to the studies of exposure histories of meteorites, we study terrestrial ages and pairing of Antarctic meteorites and desert meteorites. Terrestrial ages of

Antarctic meteorites provide information on meteorite accumulation mechanisms, mean weathering lifetimes, and influx rates. The determination of CL-36 (half-life=3.01 x 10(exp 5) y) terrestrial ages is one of our long-term on-going projects, however, in many instances neither CL-36 or C-14 (5,730 y) yields an accurate terrestrial age. Using Ca-41 (1.04 x 10(exp 5) y) for terrestrial age determinations solves this problem by filling the gap in half-life between C-14 and CL-36 ages. We are now applying the new Ca-41 - CL-36 terrestrial age method as well as the CL-36 - Be-10 method to Antarctic meteorites. Our measurements and C-14 terrestrial age determinations by the University of Arizona group are always complementary.

Derived from text

Antarctic Regions; Meteorites; Beryllium Isotopes; Calcium Isotopes; Carbon 14; Radioactive Isotopes; Chronology; Chlorine

20000070533 Kyushu Univ., Dept. of Earth and Planetary Sciences, Fukuoka, Japan

Thermal Effects on Mineralogy, Noble-Gas Composition, and Carbonaceous Material in CM Chondrites

Nakamura, Tomoki, Kyushu Univ., Japan; Kitajima, Fumio, Kyushu Univ., Japan; Takaoka, Nobuo, Kyushu Univ., Japan; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 61-63; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Many CM chondrites have been found among Antarctic meteorites that have experienced thermal metamorphism after aqueous alteration [e.g., 1-10]. They are samples of hydrous asteroids recording more advanced evolution processes than normal CM chondrites. In the present study, mineralogy, noble-gas composition, and carbonaceous material of five CM chondrites were characterized, in order to see progressive changes of CM chondrites with increasing degree of heating.

Derived from text

Meteoritic Composition; Temperature Effects; Carbonaceous Materials; Chondrites; Metamorphism (Geology); Meteorites

20000070534 NASA Johnson Space Center, Houston, TX USA

Type 1 Cosmic Spherules: Key to a Major, But Poorly Sampled, Asteroid Population?

Nyquist, L. E., NASA Johnson Space Center, USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 65-66; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Herzog et al. have determined Fe, Ni, and Cr abundances in Type I cosmic spherules recovered from the deep sea, and also the isotopic fractionation of these elements during passage of the spherules through the terrestrial atmosphere. Isotopic fractionation for all three elements is typically large, approx.16%(sigma)/amu, corresponding to evaporative mass losses of approx.80-85%, assuming Rayleigh distillation from an open system. The corrected, pre-atmospheric, Cr/Ni and Fe/Ni ratios are shown in Figure 1, where they are compared to these ratios in bulk chondrites and chondritic metal. Although the calculated pre-atmospheric Fe/Ni ratio for the spherules is relatively constant at 19+/-4 (sigma(sub mean), the calculated pre-atmospheric Cr/Ni ratios vary by about two orders of magnitude. The Cr/Ni ratios are thus powerful discriminators for possible modes of origin of the spherules. For example, iron meteorites typically have low Cr contents and low Cr/Ni ratios,:less than or equal to 3 x 10(exp -4). Thus, Type I spherules do not appear to be ablation products of iron meteorites, in contrast to an earlier suggestion.

Derived from text

Spherules; Chondrites; Asteroids; Iron Meteorites; Ablation

20000070535 Max-Planck-Inst. fuer Chemie, Mainz, Germany

Do Weathering Effects Influence Cosmic Ray Exposure Ages of Enstatite Chondrites?

Patzer, Andrea, Max-Planck-Inst. fuer Chemie, Germany; Schultz, Ludolf, Max-Planck-Inst. fuer Chemie, Germany; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 67-68; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The cosmic ray record and exposure ages (CREA's) of 62 Enstatite chondrites have been reported recently. As one of the main results, an age spectrum has been given ranging between 1 and 60 Ma. A similar spectrum is known for the ordinary chondrites. One surprising aspect, however, that has not been observed for ordinary chondrites, is a significant difference between CREA's calculated from cosmogenic Ne-21 and Ar-38, respectively (Fig. 1). Since Ne-21-exposure ages are believed to be the most reliable, not concordant Ar-ages need to be explained. In some Enstatite chondrites (EC) with high concentrations of trapped Ar, high Ar-38-ages compared to Ne-21-ages are determined. This discrepancy is probably caused by insufficient correction for trapped Ar-38 as the trapped Ar-36/Ar-38 ratio is not well known. Other EC with lower abundances of trapped Ar show - again in comparison with the Ne-21-ages - considerably lower Ar-38-ages. In those cases we suggested that weathering effects may be responsible for the difference. Most notably Ca, one main target element of cosmogenic Ar-38, partly resides in minerals readily affected by terrestrial alteration. The comparatively abundant metal phase (Kamazite) represents another target nuclide. The dissolution or

decomposition of both metal and Ca-bearing minerals, like oldhamite (CaS) as well as plagioclase, presumably results in a loss of cosmogenic Ar-38. As a consequence, the calculated Ar-38-exposure ages are too small.
Derived from text
Weathering; Cosmic Rays; Exposure; Enstatite; Chondrites; Cosmology

20000070536 Los Alamos National Lab., Space and Remote Sensing Science Group, NM USA
Solar-Cosmic-Ray-Produced Nuclides in Extraterrestrial Matter
Reedy, Robert C., Los Alamos National Lab., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 69-71; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

There are two main types of cosmic rays that have sufficient energy to induce nuclear reactions -- the galactic cosmic rays (GCR) and solar cosmic rays (also called solar energetic particles). Both types of particles can have production rates and production ratios in the small objects often found in cold and hot deserts that are different from those seen for most meteorites, which typically have radii of approx.10-100 centimeters. GCR production rates are often lower than those for most meteorites. GCR production ratios, such as Ne-22/Ne-21, are also often different in small objects. Smaller meteoroids also are more likely to have nuclides made by solar-cosmic-ray (SCR) particles than typically-sized meteorites. The very small meteorite Salem had large amounts of SCR-produced radionuclides. Meteorites recovered in Antarctica are more likely to contain SCR-produced nuclides than other meteorites. Martian and lunar meteorites are also likely to have SCR-produced nuclides. Production rates and profiles for SCR-produced nuclides in meteoroids have been calculated previously. However, the cross sections for the nuclear reactions making many SCR-produced nuclides, such as Be-10, were not well measured then. New rates and profiles are calculated here using good cross sections for the reactions making these nuclides.
Derived from text
Solar Cosmic Rays; Nuclides; Extraterrestrial Matter; Energetic Particles; Radioactive Isotopes; Galactic Cosmic Rays

20000070537 Max-Planck-Inst. fuer Chemie, Mainz, Germany
Noble Gases in 15 Meteorites from the Sahara: Eucrites, Ureilites, and Ordinary Chondrites
Scherer, Peter, Max-Planck-Inst. fuer Chemie, Germany; Paetsch, Matthias, Max-Planck-Inst. fuer Chemie, Germany; Schultz, Ludolf, Max-Planck-Inst. fuer Chemie, Germany; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 72-73; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In recent years the Sahara has become an important source of new meteorite finds. Especially in Libya the two recovery areas Dar al Gani (DaG) and Hammadah al Hamra (HaH) have yielded between 1990 and 1999 more than 850 meteorites. Several finds from hot deserts are heavily weathered and a meteoritic origin is not obvious from a first inspection. We report here noble gas analyses of 11 ordinary chondrites that are identified as meteorites by their noble gas record. These measurements have been carried out before other investigations took place and showed unambiguously that these rocks are meteorites. It should be mentioned that also several pseudometeorites with the appearance of meteorites were analyzed but their noble gas record did not indicate an extra-terrestrial origin; these results are not reported here. In addition, two eucrites and two ureilites from the Sahara were analyzed in connection with radionuclide measurements.
Derived from text
Gas Analysis; Chondrites; Meteorites; Rare Gases

20000070538 Verish (Robert S.), Sunland, CA USA
Deflation and Meteorite Exposure on Playa Lakes in the Southwestern USA: Unpaired Meteorites at Lucerne Dry Lake, California
Verish, Robert S., Verish (Robert S.), USA; Rubin, Alan E., California Univ., USA; Moore, Carleton B., Arizona State Univ., USA; Oriti, Ronald A., Oriti (Robert A.), USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 74-75; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Numerous dry lakes (playas) dot the Mojave Desert in Southern California and adjacent desert regions in Nevada and Arizona. Most have been significantly affected by deflation processes aided by the lack of protective vegetation and occurrence of fine-grained sediments. Meteorites have been found on several playas including Lucerne Dry Lake,Rogers (formerly Muroc) Dry Lake, Rosamond Dry Lake, Roach Dry Lake, Alkali Dry Lake, and an unnamed dry lake near the town of Bonnie Claire in Nye County, Nevada. Unpaired meteorites have been found near one another on the same playa. Since 1963, 17 meteorite specimens (1.2-37.4 g), collectively called Lucerne Valley, have been found on Lucerne Dry Lake. Most appear to be completely covered with fusion crust, suggesting that their small size is due to fragmentation in the atmosphere and not to terrestrial weath-

ering. The collection of meteorites on Lucerne Dry Lake is aided by the paucity of terrestrial rocks coarser than small pebbles; this is unusual for dry lakes in the region. Sixteen of the meteorite specimens from Lucerne Dy Lake were available for analysis. Derived from text

Meteorites; Mojave Desert (CA); Crusts; Sediments; Rocks; Playas

20000070539 California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA
Iron Meteorites from Antarctica: More Specimens, Still 40% Ungrouped
Wasson, J. T., California Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 76-80; In English; See also 20000070517
Contract(s)/Grant(s): NAG5-4568; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Clarke (1986) was the first to recognize that ungrouped irons are more common in Antarctica than in the regions where most irons have been collected; his conclusion was based on the first 21 irons collected in Antarctica. Wasson et al. (1989) reported compositional data for 24 Antarctic irons and reported that 8 were ungrouped; the ungrouped fraction of 0.33 was found to be about twice that (0.153) observed in irons from the remainder of the world. Wasson (1990) reported data for 7 additional Antarctic irons, and reported that 12 of 31 were ungrouped, a fraction of 0.39. In Table 1 I summarize the data obtained to date on independent Antarctic iron meteorites by our UCLA neutron-activation laboratory. With about 5 exceptions, the listed values are the means of duplicate determinations. We have now analyzed 40 independent iron meteorites; in Table 2 I list 8 other irons that proved to be paired with meteorites listed in Table 1. Because of the close relationship between pallasites and iron meteorites, in Table 3 I also list our data for two Antarctic pallasites that were studied at UCLA. Our new results confirm the previously reached conclusion about the abundance of ungrouped irons. In fact, the ungrouped fraction has increased slightly; of the 40 irons 16 are ungrouped, a fraction of 0.40. The two meteorites with pallasite structures are both small (approx. equals 50 g); one is ungrouped, the other a high-Ir anomalous member of the main-group pallasites (PMG).
Derived from text

Iron Meteorites; Antarctic Regions; Neutron Activation Analysis

20000070540 Muenster Univ., Inst. fuer Planetologie, Germany
The Libyan Meteorite Population
Weber, D., Muenster Univ., Germany; Zipfel, J., Max-Planck-Inst. fuer Chemie, Germany; Bischoff, A., Muenster Univ., Germany; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 81-82; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

During the last decade more than 2000 meteorites were found in the Sahara. Two extraordinary recovery areas are the Hammadah al Hamra (HH) and the Dar al Gani (DG) regions in Libya, where more than 850 meteorites were collected from 1990 to 1999 (>800 meteorites from 1994- 1999). At present, more than 750 meteorites are classified (Meteoritical Bulletins No. 71, 80-83) by detailed mineralogical and chemical studies. The classifications include the meteorite class and usually the degrees of shock metamorphism and weathering, the chemical composition of major phases (e.g., olivine and pyroxene) and striking petrographic features such as brecciation or the occurrence of shock veins or impact melts. The mentioned find sites are large, flat and almost featureless desert areas (the so-called "Regs"), covered with light-coloured sediments. The erosion rate is low as indicated by terrestrial ages of the meteorites up to 30000 years or even more. In these areas, the meteorite search is done by car. From the field of view, the average driving distance and find rate per day, a meteorite abundance of around 1.2 meteorites per square kilometer can be calculated. However, the single mass of a meteorite from the Sahara (and especially from DG and HH) is usually larger than 150g, which is, on average, higher than the typical masses of meteorites from Antarctica, Roosevelt County and Nullarbor, which range between 10 and 100g. It can be concluded that most small samples in the Sahara were overlooked and that, therefore, the meteorite abundance should be higher than the estimated value of 1.2/sq km.
Derived from text

Meteorites; Metamorphism (Geology); Chemical Composition; Libya; Deserts; Impact Melts

20000070541 California Univ., Space Science Lab., Berkeley, CA USA
Degree of Weathering of H-Chondrites From Frontier Mountain, Antarctica
Welten, K. C., California Univ., USA; Nishiizumi, K., California Univ., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 83-87; In English; See also 20000070517
Contract(s)/Grant(s): NAG5-4992; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

One of the factors that determines the survival time of meteorites on the Earth's surface is the rate of weathering. For meteorites from hot deserts, a clear correlation is found between the degree of weathering, and the terrestrial age, but for Antarctic meteorites this correlation is weak or even lacking. The lack of a clear correlation can partly be attributed to the two-stage history of many

Antarctic meteorites, which spend part of their terrestrial residence time in the ice before they are exposed on the ice. Recently, it was found that for Lewis Cliff (LEW) meteorites local conditions on the ice play an important role in the weathering process. This work focuses on weathering effects in ordinary chondrites from Frontier Mountain (FRO), North Victoria Land. Although most FRO meteorites were classified as weathering category A or B, many are contaminated with terrestrial uranium, deposited from meltwater. This suggests that weathering plays a more significant role than the qualitative A-B-C weathering index indicates. We therefore determined the degree of weathering more quantitatively, by deriving the amount of oxidized metal from the concentrations of Fe and Ni in the nonmagnetic fraction of 23 H-chondrites and 1 L-chondrite The results will be compared with those of LEW meteorites and will be discussed in terms of terrestrial age and location of find on the ice.
Derived from text
Weathering; Chondrites; Antarctic Regions; Meteoritic Composition

20000070542 California Univ., Space Sciences Lab., Berkeley, CA USA
Cosmogenic Radionuclides in Hot Desert Chondrites With Low C-14 Activities *Progress Report*
Welten, K. C., California Univ., USA; Nishiizumi, K., California Univ., USA; Caffee, M. W., Lawrence Livermore National Lab., USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 88-89; In English; See also 20000070517
Contract(s)/Grant(s): W-7405-eng-48; NAG5-4992; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Terrestrial ages of meteorites from hot deserts provide an important tool to estimate meteorite fluxes to the Earth. Most desert meteorites have terrestrial ages less than 40 ky, but a few achondrites from the Sahara region were recently shown to have significantly higher ages, up to approx.100 ky. In general, C-14 (half-life = 5730 y) is the most suited radionuclide to determine terrestrial ages for desert meteorites. However for meteorites with ages is greater than 35 ky, the concentration of cosmogenic C-14 has decreased to a level at which it becomes difficult to distinguish between cosmogenic C-14 and terrestrial contamination. These meteorites may therefore be much older than 35 ky. We selected chondrites with low C-14 activities (less than or equal to 2 dpm/kg) for measurements of the concentrations of cosmogenic CL-36 (half-life= 3.01 x 10(exp 5) y) and Ca-41 (half-life= 1.04 x 10(exp 5) y) in the metal phase. Since the ratio of Ca-41/CL-36 in the metal phase of chondrites is relatively constant and well known, the measured ratio is a direct measure of the terrestrial age]. A major problem is that most or sometimes all. of the metal in these old "hot desert" meteorites has been oxidized to hydrated Fe-Ni-oxides. Therefore, we also measured the concentrations of Be-10, Al-26 and CL-36 in the stony phase in order to constrain the terrestrial age as much as possible.
Derived from text
Radioactive Isotopes; Cosmology; Meteorites; Carbon 14; Chlorine; Chondrites; Beryllium Isotopes; Calcium Isotopes; Aluminum Isotopes

20000070543 Eidgenoessische Technische Hochschule, Isotope Geology and Mineral Resources, Zurich, Switzerland
Noble Gases in Desert Meteorites: Howardities, Unequilibrated Chondrites, Regolith Breccias and an LL7
Wieler, R., Eidgenoessische Technische Hochschule, Switzerland; Baur, H., Eidgenoessische Technische Hochschule, Switzerland; Busemann, H., Eidgenoessische Technische Hochschule, Switzerland; Heber, V. S., Eidgenoessische Technische Hochschule, Switzerland; Leya, I., Eidgenoessische Technische Hochschule, Switzerland; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 90-94; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

We present He, Ne, and Ar data of 39 samples from 17 meteorites of various types. For three CV3 and two unequilibrated ordinary chondrites Kr and Xe data are also reported. The analyses served various purposes, e. g. to check for presence of solar noble gases, to determine concentrations of primordial noble gases, to study cosmic ray exposure ages including possible parent body exposures, and to recognize paired meteorites. The data are shown in Tables 1 and 2. Ne-21 exposure ages are calculated with the cosmogenic nuclide production model by Leya et al., assuming average chemical composition of the respective meteorite class and taking the (Ne-22/Ne-21)cos ratio as shielding parameter. In some cases we had to assume additionally a meteoroid radius is less than 32 cm. We report an age range (T(sup 21) min - T(sup 21) max) rather than a single age to indicate that even when (Ne-22/Ne-21)cos is available, meteoroid size and sample depth are not unambiguously known, hence the Ne-21 production rate is only constrained to within certain limits. The mean production rates used here compare well with those given by Eugster and Eugster and Michel for (Ne-22/Ne-21)cos values between 1.08 - 1.12 (chondrites) and 1.10 - 1.15 (howardites), respectively. On the other hand, our values are up to 30% lower for high (Ne-22/Ne-21)cos values, i.e. small meteorites and low shielding.
Derived from text
Meteoritic Composition; Meteorites; Gas Composition; Rare Gases; Deserts; Chondrites; Chemical Composition

NASA Johnson Space Center, Houston, TX USA

Identical Origin for Halide and Sulfate Efflorescences on Meteorite Finds and Sulfate Veins in Orgueil

Zolensky, M. E., NASA Johnson Space Center, USA; Workshop on Extraterrestrial Materials from Cold and Hot Deserts; 2000, pp. 95; In English; See also 20000070517; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Halide and sulfate efflorescences are common on meteorite finds, especially those from cold deserts. Meanwhile, the late-stage sulfate veins in Orgueil are universally accepted as having originated by the action of late-stage high fO2 aqueous alteration on an asteroid. I suggest here that these phenomena have essentially the same origin.

Derived from text

Meteorites; Halides; Sulfates

Hawaii Univ., Inst. for Astronomy, Honolulu, HI USA

Distant Comets in the Early Solar System *Annual Report, 1 Apr. 1999 - 31 Mar. 2000*

Meech, Karen J., Hawaii Univ., USA; May 23, 2000; 9p; In English

Contract(s)/Grant(s): NAG5-4495

Report No.(s): Rept-6-54721; Rept-6-55409; Rept-6-55943; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The main goal of this project is to physically characterize the small outer solar system bodies. An understanding of the dynamics and physical properties of the outer solar system small bodies is currently one of planetary science's highest priorities. The measurement of the size distributions of these bodies will help constrain the early mass of the outer solar system as well as lead to an understanding of the collisional and accretional processes. A study of the physical properties of the small outer solar system bodies in comparison with comets in the inner solar system and in the Kuiper Belt will give us information about the nebular volatile distribution and small body surface processing. We will increase the database of comet nucleus sizes making it statistically meaningful (for both Short-Period and Centaur comets) to compare with those of the Trans-Neptunian Objects. In addition, we are proposing to do active ground-based observations in preparation for several upcoming space missions.

Author

Solar System; Comet Nuclei; Data Bases; Size Distribution; Dynamic Characteristics; Electromagnetic Properties

NASA Marshall Space Flight Center, Huntsville, AL USA

Sunyaev-Zeldovich Effect-Derived Distances to the High-Redshift Clusters

Reese, Erik D., Chicago Univ., USA; Mohr, Joseph J., Chicago Univ., USA; Carlstrom, John E., Chicago Univ., USA; Joy, Marshall, NASA Marshall Space Flight Center, USA; Grego, Laura, Harvard-Smithsonian Center for Astrophysics, USA; Holder, Gilbert P., Chicago Univ., USA; Holzapfel, William L., California Univ., USA; Hughes, John P., Rutgers Univ., USA; Patel, Sandeep K., NASA Marshall Space Flight Center, USA; Donahue, Megan, Space Telescope Science Inst., USA; Astrophysical Journal; Apr. 10, 2000; Volume 533, pp. 38-49; In English; Sponsored in part by the Chandra Science Center

Contract(s)/Grant(s): NAS8-39073; NAG5-7986; NSF AST-96-13717; NSF AST-96-13998; NAG5-50173; NGT-51201; NGT8-52863; NAG5-3432; PF8-1003; Copyright; Avail: Issuing Activity

We determine the distances to the z approximately equals 0.55 galaxy clusters MS 0451.6 - 0305 and Cl 0016 + 16 from a maximum-likelihood joint fit to interferometric Sunyaev-Zeldovich effect (SZE) and X-ray observations. We model the intra-cluster medium (ICM) using a spherical isothermal beta model. We quantify the statistical and systematic uncertainties inherent to these direct distance measurements, and we determine constraints on the Hubble parameter for three different cosmologies. For an Omega(sub M) = 0.3, Omega(sub lambda) = 0.7 cosmology, these distances imply a Hubble constant of 63(sup +12) (sub -9) (sup + 21) (sub -21) km/s Mp/c, where the uncertainties correspond to statistical followed by systematic at 68% confidence. The best-fit H(sub 0) is 57 km/s Mp/c for an open (Omega(sub M) = 0.3) universe and 52 km/s Mp/c for a flat (Omega(sub M) = 1) universe.

Author

Background Radiation; Distance; Galactic Clusters; Intergalactic Media

Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France

Gravitational Wave Bursts from Cosmic Strings

Damour, T.; Vilenkin, A.; Apr. 26, 2000; 10p; In English

Report No.(s): PB2000-106223; IHES/P/00/32; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

Cusps of cosmic strings emit strong beams of high-frequency gravitational waves (GW). As a consequence of these beams, the stochastic ensemble of gravitational waves generated by a cosmological network of oscillating loops is strongly non-Gaussian, and includes occasional sharp bursts that stand above the rms GW background. These bursts might be detectable by the planned

GW detectors LIGO/VIRGO and LISA for string tensions as small as G(mu) is approximately 10 to the -13th power. The GW bursts discussed here might be accompanied by Gamma Ray bursts.

NTIS

Cosmology; Gravitational Waves; String Theory; Supersymmetry

20000072440 NASA Goddard Space Flight Center, Greenbelt, MD USA

Constraints on Energy Dissipation in the Earth's Body Tide From Satellite Tracking and Altimetry

Ray, Richard D., NASA Goddard Space Flight Center, USA; Eanes, Richard J., Texas Univ., USA; Lemoine, Frank G., NASA Goddard Space Flight Center, USA; [1992]; 13p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The phase lag by which the earth's body tide follows the tidal potential is estimated for the principal lunar semidiurnal tide M(sub 2). The estimate results from combining recent tidal solutions from satellite tracking data and from TOPEX/Poseidon satellite altimeter data. Each data type is sensitive to the body-tide lag: gravitationally for the tracking data, geometrically for the altimetry. Allowance is made for the lunar atmospheric tide. For the tidal potential Love number kappa(sub 2) we obtain a lag epsilon of 0.20 deg +/- 0.05 deg, implying an effective body-tide Q of 280 and body-tide energy dissipation of 110 +/- 25 gigawatts.

Author

Energy Dissipation; Altimetry; Diurnal Variations; Earth Tides; Satellite Tracking

20000072445 NASA Goddard Space Flight Center, Greenbelt, MD USA

Laboratory Astrophysics Using a Spare XRS Microcalorimeter

Audley, M. Damian, NASA Goddard Space Flight Center, USA; Beiersdorfer, Peter, Lawrence Livermore National Lab., USA; Porter, Frederick Scott, NASA Goddard Space Flight Center, USA; Brown, Gregory, Lawrence Livermore National Lab., USA; Boyce, Kevin R., NASA Goddard Space Flight Center, USA; Brekosky, Regis, Swales and Associates, USA; Brown, Gregory V., Lawrence Livermore National Lab., USA; Gendreau, Keith C., NASA Goddard Space Flight Center, USA; Gygax, John, Swales and Associates, USA; Kahn, Steve, Columbia Univ., USA; Kelly, Richard L., NASA Goddard Space Flight Center, USA; [2000]; 3p; In English; 45th, 1-4 Aug. 2000, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The XRS instrument on Astro-E is a fully self-contained microcalorimeter x-ray instrument capable of acquiring optimally filtering, and characterizing events for 32 independent pixels. With the launch of the Astro-E spacecraft, a full flight spare detector system has been integrated into a laboratory cryostat for use on the electron beam ion trap (EBIT) at Lawrence Livermore National Laboratory. The detector system contains a microcalorimeter array with 32 instrumented pixels heat sunk to 60 mK using an adiabatic demagnetization refrio,erator. The instrument has a composite resolution of 8eV at 1 keV and 12eV at 6 keV with a minimum of 95% quantum efficiency. This will allow high spectral resolution, broadband observations of collisionally excited plasmas which are produced in the EBIT experiment. Unique to our instrument are exceptionally well characterized 1000 Angstrom thick aluminum on polyimide infrared blocking filters. The detailed transmission function including the edc,e fine structure of these filters has been measured in our laboratory using an erect field grating spectrometer. This will allow the instrument to perform the first broadband absolute flux measurements with the EBIT instrument. The instrument performance as well as the results of preliminary measurements will be discussed. Work performed under the auspices of the U.S. D.o.E. by Lawrence Livermore National Laboratory under contract W-7405-ENG-48 and was supported by the NASA High Energy Astrophysics Supporting Research and Technology Program.

Author

X Ray Detectors; Electron Beams; Spectral Resolution; Magnetic Fields; Ion Beams; Calorimeters

20000072574 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The First Few Parsecs of the Jets in NGC 4261

Jones, Dayton L., Jet Propulsion Lab., California Inst. of Tech., USA; Wehrle, Ann E., Jet Propulsion Lab., California Inst. of Tech., USA; 2000; 10p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The double-lobed radio galaxy NGC 4261 (3C270) contains a pair of highly symmetric kpc-scale jets, as well as a two-sided morphology on parsec scales. Optical imaging with HST has revealed a large, nearly edge-on nuclear disk of gas and dust. This suggests that the radio axis is close to the plane of the sky and consequently that the relative brightness of the two jets is not significantly affected by relativistic beaming.

Author

Radio Galaxies; Plasma Jets; Very Long Baseline Array (VLBA)

20000072578 NASA Goddard Inst. for Space Studies, New York, NY USA

A Clue to the Extent of Convective Mixing Inside Massive Stars: The Surface Hydrogen Abundances of Luminous Blue Variables and Hydrogen-Poor Wolf-Rayet Stars

Stothers, Richard B., NASA Goddard Inst. for Space Studies, USA; Chin, Chao–wen, NASA Goddard Inst. for Space Studies, USA; [1999]; 28p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Interior layers of stars that have been exposed by surface mass loss reveal aspects of their chemical and convective histories that are otherwise inaccessible to observation. It must be significant that the surface hydrogen abundances of luminous blue variables (LBVs) show a remarkable uniformity, specifically X(sub surf) = 0.3 - 0.4, while those of hydrogen-poor Wolf-Rayet (WN) stars fall, almost without exception, below these values, ranging down to X(sub surf) = 0. According to our stellar model calculations, most LBVs are post-red-supergiant objects in a late blue phase of dynamical instability, and most hydrogen-poor WN stars are their immediate descendants. If this is so, stellar models constructed with the Schwarzschild (temperature-gradient) criterion for convection account well for the observed hydrogen abundances, whereas models built with the Ledoux (density-gradient) criterion fail. At the brightest luminosities, the observed hydrogen abundances of LBVs are too large to be explained by any of our highly evolved stellar models, but these LBVs may occupy transient blue loops that exist during an earlier phase of dynamical instability when the star first becomes a yellow supergiant. Independent evidence concerning the criterion for convection, which is based mostly on traditional color distributions of less massive supergiants on the Hertzsprung-Russell diagram, tends to favor the Ledoux criterion. It is quite possible that the true criterion for convection changes over from something like the Ledoux criterion to something like the Schwarzschild criterion as the stellar mass increases.
Author
Convection; Hydrogen; Abundance; A Stars; Hertzsprung-Russell Diagram; Luminosity; Supergiant Stars; Wolf-Rayet Stars

20000073292 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Substorm Pseudobreakups Associated with Interplanetary Shocks/Pressure Pulses: Wind and Polar

Zhou, X.–Y., Jet Propulsion Lab., California Inst. of Tech., USA; Tsurutani, B. T., Jet Propulsion Lab., California Inst. of Tech., USA; Arballo, J. K., Jet Propulsion Lab., California Inst. of Tech., USA; Berdichevsky, D., NASA Goddard Space Flight Center, USA; Lepping, R., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Ten interplanetary WIND shock/ pressure pulse events are used to study the magnetospheric delay of pseudobreakup (PB) or substorm onsets. We identify the PBs and substorms by using the POLAR UV imaging data. The states of the interplanetary medium and the conditions of the ionosphere before and after the auroral brightening onsets are studied. We find that the magnetospheric delay time strongly constrains the location of the nightside X-line during such events. We also find for PB (or no activity) events, that the interplanetary and ionosphere preconditions are unusually low.
Author
Auroras; Ionospheric Storms; Earth Ionosphere; Solar Storms; Earth Magnetosphere; Polar Substorms

20000073388 NASA Marshall Space Flight Center, Huntsville, AL USA

The Fall 2000 and Fall 2001 SOHO-Ulysses Quadratures

Suess, S. T., NASA Marshall Space Flight Center, USA; Poletto, G., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 34th; 34th ESLAB Symposium, 3-5 Oct. 2000, Noordwijk, Netherlands; No Copyright; Avail: Issuing Activity; Abstract Only

SOHO-Ulysses quadrature occurs when the SOHO-Sun-Ulysses included angle is 90 degrees. It is only at such times that the same plasma leaving the Sun in the direction of Ulysses can first be remotely analyzed with SOHO instruments and then later be sampled in situ by Ulysses instruments. The quadratures in December 2000 and 2001 are of special significance because Ulysses will be near the south and north heliographic poles, respectively, and the solar cycle will be near sunspot maximum. Quadrature geometry is sometimes confusing and observations are influenced by solar rotation. The Fall 2000 and 2001 quadratures are more complex than usual because Ulysses is not in a true polar orbit and the orbital speed of Ulysses about the Sun is becoming comparable to the speed of SOHO about the Sun. In 2000 Ulysses will always be slightly behind the pole but will appear to hang over the pole for over two months because it is moving around the Sun in the same direction as SOHO. In 20001, Ulysses will be slightly in front of the pole so that its footpoint will be directly observable. Detailed plots will be shown of the relative positions of SOHO and Ulysses will their relative positions. In neither case is true quadrature actually achieved, but this works to the observers advantage in 2001.
Author
Ulysses Mission; SOHO Mission; Quadratures; Sun

20000073718 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Progress in a Study of Striations in the Dust Tail of Comet Hale-Bopp (C/1995 O1)

Sekanina, Z., Jet Propulsion Lab., California Inst. of Tech., USA; Ryan, O., European Southern Observatory, Chile; Boehnhardt, H., European Southern Observatory, Chile; Birkle, K., Max-Planck-Inst. fuer Astronomie, Germany; Engels, D., Hamburger Sternwarte G.m.b.H., Germany; Jaeger, M.; Keller, P.; Raab, H.; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We report preliminary results of a massive investigation of the striation patterns observed in the dust tail of comet Hale-Bopp in March and April 1997. Our findings are based on 16 wide-field photographs taken with Schmidt cameras on March 2-20, with six more, from March 31-April 8, still waiting for analysis. Altogether approximately 700 individual striae were examined on the 16 images, which were scanned and computer processed to enhance the morphology. About 5300 stria points, or some 7-8 points per stria per image on the average, were measured and their astrometric positions determined and subsequently converted to a Cartesian coordinate system, aligned with the comet's projected radius vector and centered on the nucleus. The evolution of the striated tail has been studied using the Sekanina-Farrell fragmentation hypothesis (AJ 85, 1538, 1980), previously applied to other comets. This two-step model is characterized by the time of release from the nucleus of a parent object (or objects) whose motion is assumed to have been subjected to a constant repulsive acceleration beta(sub p) (presumably due to solar radiation pressure) until the time of fragmentation.
Derived from text
Striation; Comet Tails; Cometary Atmospheres; Hale-Bopp Comet; Astrometry; Fragmentation

20000074059 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Stardust: The Adventure has Begun

Duxbury, Thomas C., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The NASA Discovery STARDUST Mission was launched in February, 1999 to fly through the coma of P/Wild 2 in January, 2004 and return captured cometary and interplanetary dust particles to earth in January, 2006 for detailed analyses by the international science community. The STARDUST spacecraft is carrying a dust collector employing JPL Aerogel for collecting interstellar dust during interplanetary cruise and cometary dust during Wild 2 flyby. Additional instrumentation include the MPI fur Extraterrestrische Physik Cometary and Interplanetary Dust Analyzer, the University of Chicago Dust Flux Monitor and the JPL Imaging Camera. Doppler tracking of the spacecraft and high rate attitude orientation and body-fixed rate data from engineering subsystems will also provide science information. The presentation will describe the mission, scientific objectives and current state of the spacecraft in detail.
Author
Cosmic Dust; Interplanetary Dust; Stardust Mission; Wild 2 Comet

20000074062 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

SIRTF Studies of Galaxy Formation and Evolution

Eisenhardt, Peter, Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; 24th; 19th; 24th Recontres De Moriond: Building Galaxies from the Primordial Universe to the Present, 13-20 Mar. 1999, Les Arcs, Savoie, Les Arcs, Savoie, France, France; No Copyright; Avail: Issuing Activity; Abstract Only

The Space Infrared Telescope Facility (SIRTF) is a cornerstone of NASA's Origins program, and will complete NASA's family of Great Observatories when it is launched in December 2001. SIRTF will provide imaging with point source sensitivities ranging from a few microjanskies at 3.6 microns to several millijanskies at 160 microns, land spectroscopy of sources brighter than a millijansky over the 5 to 40 micron range. Over 75% of observing time during SIRTF's expected 5 year lifetime will be available to general investigators from the international community, with the first call for proposals in July 2000. I review SIRTF's capabilities and plans for the study of galaxy formation and evolution. This work was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under contract to the National Aeronautics and Space Administration.
Author
Galactic Evolution; NASA Programs; Space Infrared Telescope Facility

20000074064 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The LISA Mission Design

Folkner, W. M., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The proposed Laser Interferometer Space Antenna (LISA) is designed to observe gravitational radiation from galactic binaries and massive black holes in other galaxies. LISA will observe waves in the frequency range 0.1 mHz to 1 Hz, which can never be observed on Earth due to background noise. The three LISA spacecraft will be located at the vertices of an equilateral triangle with side length 5 million km. The orbits are chosen so that the triangle formation trails the Earth by 20 degrees. Each spacecraft will contain two independent instruments containing a proof mass, laser and 30 cm diameter telescope for the transmission and reception of laser signals. Two independent Michelson interferometers will be formed, allowing both polarizations of gravitational waves to be detected. The observed signals will yield unique information about the formation of massive black holes and the nature of gravity in the high-field limit.

Author

Laser Interferometry; Galaxies; Binary Stars; Black Holes (Astronomy); Gravitational Waves

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.

20000068933 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

The State and Future of Mars Polar Science and Exploration

Clifford, Stephen M., Lunar and Planetary Inst., USA; Crisp, David, Jet Propulsion Lab., California Inst. of Tech., USA; Fisher, David A., Geological Survey of Canada, Canada; Herkenhoff, Ken E., Geological Survey, USA; Smrekar, Suzanne E., Jet Propulsion Lab., California Inst. of Tech., USA; Thomas, Peter C., Cornell Univ., USA; Wynn–Williams, David D., Natural Environment Research Council, UK; Zurek, Richard W., Jet Propulsion Lab., California Inst. of Tech., USA; Barnes, Jeffrey R., Oregon State Univ., USA; Bills, Bruce G., NASA Goddard Space Flight Center, USA; Icarus; 2000; Volume I44, pp. 210-242; In English; Original contains color illustrations

Report No.(s): LPI-Contrib-987; Copyright; Avail: Issuing Activity

As the planet's principal cold traps, the martian polar regions have accumulated extensive mantles of ice and dust that cover individual areas of approx. 10(exp 6)sq km and total as much as 3-4 km thick. From the scarcity of superposed craters on their surface, these layered deposits are thought to he comparatively young-preserving a record of the seasonal and climatic cycling of atmospheric CO_2, H_2O, and dust over the past approx. 10(exp 5)-10(exp 8) years. For this reason, the martian polar deposits may serve as a Rosetta Stone for understanding the geologic and climatic history of the planet-documenting variations in insolation (due to quasiperiodic oscillations in the planet's obliquity and orbital elements), volatile mass balance, atmospheric composition, dust storm activity, volcanic eruptions, large impacts, catastrophic floods, solar luminosity, supernovae, and perhaps even a record of microbial life. Beyond their scientific value, the polar regions may soon prove important for another reason-providing a valuable and accessible reservoir of water to support the long-term human exploration of Mars. In this paper we assess the current state of Mars polar research, identify the key questions that motivate the exploration of the polar regions, discuss the extent to which current missions will address these questions, and speculate about what additional capabilities and investigations may be required to address the issues that remain outstanding.

Author

Mars Surface; Mars (Planet); Ice; Climatology; Atmospheric Composition

20000068934 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Photochemistry Saturn's Atmosphere, 2, Effects of an Influx of External Oxygen

Moses, Julianne I., Lunar and Planetary Inst., USA; Lellouch, Emmanuel, Observatoire de Paris-Meudon, France; Bezard, Bruno, Observatoire de Paris-Meudon, France; Gladstone, G. Randall, Southwest Research Inst., USA; Allen, Mark, Jet Propulsion Lab., California Inst. of Tech., USA; Icarus; 2000; ISSN 0019-1035; Volume 145, pp. 166-202; In English

Contract(s)/Grant(s): NASW-4574; NAG5-6915

Report No.(s): LPI-Contrib-983; Copyright; Avail: Issuing Activity

We use a one-dimensional diurnally averaged model of photochemistry and diffusion in Saturn's stratosphere to investigate the influence of extraplanetary debris on atmospheric chemistry. In particular, we consider the effects of an influx of oxygen from micrometeoroid ablation or from ring-particle diffusion; the contribution from cometary impacts, satellite debris, or ring vapor is deemed to be less important. The photochemical model results are compared directly with Infrared Space Observatory (ISO) observations to constrain the influx of extraplanetary oxygen to Saturn. From the ISO observations, we determine that the column densities of CO_2 and H_2O above 10 mbar in Saturn's atmosphere are (6.3 +/- 1) x 10(exp 14) and (1.4 +/- 0.4) x 10(exp 15)/ square

cm, respectively; our models indicate that a globally averaged oxygen influx of (4+/-2) x 10(exp 6) O atoms /sq cm/s is required to explain these observations. Models with a locally enhanced influx of H20 operating over a small fraction of the projected area do not provide as good a fit to the ISO H2O observations. If volatile oxygen compounds comprise one-third to one-half of the exogenic source by mass, then Saturn is currently being bombarded with (3 +/- 2) x 10(exp -16) g/square cm/s of extraplanetary material. To reproduce the observed CO2/H2O ratio in Saturn's stratosphere, some of the exogenic oxygen must arrive in the form of a carbon-oxygen bonded species such as CO or CO2. An influx consistent with the composition of cometary ices fails to reproduce the high observed CO2/H2O ratio, suggesting that (i) the material has ices that are slightly more carbon-rich than is typical for comets, (ii) a contribution from an organic-rich component is required, or (iii) some of the hydrogen-oxygen bonded material is converted to carbon-oxygen bonded material without photochemistry (e.g., during the ablation process). We have also reanalyzed the 5-micron CO observations of Noll and Larson and determine that the CO lines are most sensitive to the 100- to 400-mbar column density for which we derive a range of (0.7-1.5) x 10(exp 17)/square cm; the CO observations do not allow us to distinguish between an external or internal source of CO on Saturn. If we assume that all the extraplanetary oxygen derives from a micrometeoroid source, then the unfocused dust flux at 9.5 AU must be (i) (1 +/- 0.7) x 10(exp -16) g/square cm/s if interstellar grains are the source of the external oxygen on Saturn, (ii) (4 +/- 3) x 10 (exp -17) g/ sq. cm./s if IDPs on randomly inclined, highly eccentric orbits (e.g., Halley-type comet grains) are the source of the external oxygen, or (iii) (2+/- 1.4) x 10(exp -18)/g/sq cm/s if IDPs on low inclination, low eccentricity orbits (e.g., Kuiper-belt grains) are the source of the external oxygen. These estimates can be used in combination with future Cassini dust detection data to determine the ultimate source of the dust at Saturn's distance from the Sun.
Author
Atmospheric Chemistry; Interstellar Matter; Mathematical Models; Photochemical Reactions; Saturn (Planet); Saturn Atmosphere; Atmospheric Composition

20000068964 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Standards Supporting Cooperation on Mission Planning, Data Analysis and Correlation of Results Within a Broad-Based Mars Exploration Program
Acton, Charles H., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 16p; In English, 2-3 Feb. 1999, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    This poster is an invitation for participation in the specification and implementation of engineering and ancillary data standards, and allied software tools needed to conceptualize, designs, operate and analyze the data returned from Mars and other solar system exploration missions
Derived from text
Mission Planning; International Cooperation; Mars Exploration; Standards

20000069789 Search for Extraterrestrial Intelligence Inst., CA USA
SETI : Galactic colonization and Other Flights of Fancy
Oliver, Bernard M., Search for Extraterrestrial Intelligence Inst., USA; IEEE Potentials; August/September 1994; ISSN 0278-6648, pp. 51-54; In English; Copyright; Avail: Issuing Activity
    This article reviews the problems of manned interstellar travel in our attempts to find extraterrestrial life. The Search for Extraterrestrial Intelligence (SETI) using communication rather than space travel to achieve the goals of establishing the existence of intelligent life is advocated.
CASI
Extraterrestrial Life; Interstellar Travel; Project Seti; Long Duration Space Flight; Radio Communication; Extraterrestrial Intelligence

20000070461 NASA Kennedy Space Center, Cocoa Beach, FL USA
NASA Today - Mars Observer Segment (Part 4 of 6)
Aug. 20, 1993; In English; Viodeotape: 16 min. 20 sec. playing time, in color with sound
Report No.(s): NONP-NASA-VT-200096690; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS
    This videotape consists of eight segments from the NASA Today News program. The first segment is an announcement that there was no date set for the launch of STS-51, which had been postponed due to mechanical problems. The second segment describes the MidDeck Dynamic Experiment Facility. The third segment is about the scheduled arrival of the Mars Observer at Mars, it shows an image of Mars as seen from the approaching Observer spacecraft, and features an animation of the approach to Mars, including the maneuvers that are planned to put the spacecraft in the desired orbit. The fourth segment describes a discovery from an infrared spectrometer that there is nitrogen ice on Pluto. The fifth segment discusses the Aerospace for Kids

(ASK) program at the Goddard Space Flight Center (GSFC). The sixth segment is about the high school and college summer internship programs at GSFC. The seventh segment announces a science symposium being held at Johnson Space Center. The last segment describes the National Air and Space Museum and NASA's cooperation with the Smithsonian Institution.
CASI
Mars Observer; Museums; Pluto Atmosphere; Pluto (Planet); Mars Missions

20000070498 Brown Univ., Dept. of Geological Sciences, Providence, RI USA

Thermal Evolution of The Moon With a Thicker Kreep Layer

Hess, P. C., Brown Univ., USA; Parmentier, E. M., Brown Univ., USA; [1998], pp. 59-60; In English; 31st; LPSC, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The canonical view of the magma ocean is of a monotonically cooling large magma body perhaps enveloping the entire Moon, which solidified within about 100 my of the formation of the Moon. This model is consistent with W-Hf Sm-Nd isotope data, the very old ages of FAN and some magnesian-suite norites and troctolites and the model ages for KREEP. Recently, Korotev and Wieczorek and Phillips have argued that the crystallization of the last dregs of the magma ocean was not only prolonged but large amounts of radiogenic heating resulted in the remelting and dissolution of mafic cumulates by the UrKREEP liquid. These melts are believed to be parent liquids to the magnesian-suite troctolites because they account for the combination of high contents of incompatible trace elements and the very refractory major element composition. This model requires that the heat budget changes from one that cools the magma ocean to one that initiates reheating. About the only way to reverse this cooling trend is to segregate the magma ocean under some portions of the crust. For example, if the residual liquids are locally doubled in thickness the surface cooling is reduced thus reversing the cooling tend. by mass balance some portions of the magma ocean would be thinned and thereby would experience an accelerated cooling.accelerated cooling. We have examined the thermal history of the upper Moon. We formulate models of radioactive heating and conductive cooling to examine the possible role of a thick KREEP-rich layer on lunar regional thermal evolution. The models treat heat transfer by conduction in a spherical geometry with a KREEP layer containing a prescribed rate of radiogenic heating. The region of thick KREEP presumably exists only within the Imbrium-Procellarum region of the Moon. The spherical model is a reasonable representation of this case since the lateral dimensions of the region are large compared to its depth. The edges of the thick KREEP region which are not treated explicitly in this model will be small compared to the size of the region- As a basis for discussion we consider a 10km thick KREEP layer at the bottom of a 50km thick crust. The crust is capped with a 3km thick brecciated regolith layer in which the conductivity is reduced by a factor of ten. Within the layer we examine heating rates that are multiples of the rate radiogenic heating due to chondritic abundances of U and Th.
Derived from text
Kreep; Moon; Lunar Evolution; Lunar Geology; Depth; Thermal Analysis

20000072418 Naval Research Lab., Washington, DC USA

The State, Potential Distribution, and Biological Implications of Methane in the Martian Crust

Max, Michael D., Naval Research Lab., USA; Clifford, Stephen M., Lunar and Planetary Inst., USA; Journal of Geophysical Research; Feb. 25, 2000; ISSN 0148-0227; Volume 105, No. E2, pp. 4165-4171; In English
Contract(s)/Grant(s): DE-AT26-97FT-34344
Report No.(s): Paper 1999JE001119; LPI-Contrib-990; Copyright; Avail: Issuing Activity

The search for life on Mars has recently focused on its potential survival in deep (>2 km) subpermafrost aquifers where anaerobic bacteria, similar to those found in deep subsurface ecosystems on Earth, may have survived in an environment that has remained stable for billions of years. An anticipated by-product of this biological activity is methane. The detection of large deposits of methane gas and hydrate in the Martian cryosphere, or as emissions from deep fracture zones, would provide persuasive evidence of indigenous life and confirm the presence of a valuable in situ resource for use by future human explorers.
Author
Extraterrestrial Life; Mars (Planet); Methane; Mars Environment; Water; Mars Surface

20000073304 NASA Goddard Space Flight Center, Greenbelt, MD USA

Mars Global Surveyor Thermal Emission Spectrometer (TES) Observations of Dust Opacity During Aerobraking and Science Phasing

Smith, Michael D., NASA Goddard Space Flight Center, USA; Pearl, John C., NASA Goddard Space Flight Center, USA; Conrath, Barney J., Cornell Univ., USA; Christensen, Philip R., Arizona State Univ., USA; [1999]; 13p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Mars Global Surveyor (MGS) arrived at Mars in September 1997 near Mars southern spring equinox and has now provided monitoring of conditions in the Mars atmosphere for more than half a Mars year. The large majority of the spectra taken

by the Thermal Emission Spectrometer (TES) are in a nadir geometry (downward looking mode) where Mars is observed through the atmosphere. Most of these contain the distinct spectral signature of atmospheric dust. For these nadir-geometry spectra we retrieve column-integrated infrared aerosol (dust) opacities. TES observations during the aerobraking and science-phasing portions of the MGS mission cover the seasonal range L(sub s)=184 deg - 28 deg. Excellent spatial coverage was obtained in the southern hemisphere. Northern hemisphere coverage is generally limited to narrow strips taken during the periapsis pass but is still very valuable. At the beginning of the mission the 9-(micron)meter dust opacity at midsouthern latitudes was low (0.15-0.25). As the season advanced through southern spring and into summer, TES observed several regional dust storms (including the Noachis dust storm of November 1997) where peak 9-(micron)meter dust opacities approached or exceeded unity, as well as numerous smaller local storms. Both large and small dust storms exhibited significant changes in both spatial coverage and intensity over a timescale of a day. Throughout southern spring and summer the region at the edge of the retreating southern seasonal polar ice cap was observed to be consistently more dusty than other latitudes.
Author
Mars Global Surveyor; Thermal Emission; Opacity; Mars Missions; Mars (Planet)

20000073397 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Determination of the Last Stable Orbit for Circular General Relativistic Binaries at the Third Post-Newtonian Approximation
Damour, T.; Jaranowski, P.; Schaefer, G.; May 10, 2000; 32p; In English
Report No.(s): PB2000-106221; IHES/P/00/37; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

We discuss the analytical determination of the location of the Last Stable Orbit (LSO) in circular general relativistic orbits of two point masses. We use several different 'resummation methods' (including new ones) based on the consideration of gauge-invariant functions, and compare the results they give at the third post-Newtonian (3PN) approximation of general relativity. One of the new methods we introduce is based on the consideration of the (invariant) function linking the angular momentum and the angular frequency. We also generalize the 'effective one-body' approach of Buonanno and Damour by introducing a non-minimal (i.e., 'non-geodesic') effective dynamics at the 3PN level.
NTIS
Circular Orbits; Binary Stars; Newton Methods; Relativity; Mathematical Models; Approximation

20000073721 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Mars Orbiter Sample Return Power Design
Mardesich, N., Jet Propulsion Lab., California Inst. of Tech., USA; Dawson, S., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; 16th; Space Photovoltaic Research and Technology, 31 Aug. - 2 Sep. 1999, Cleveland, OH, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The NASA/JPL 2003/2005 Mars Sample Return (MSR) Missions will each have a sample return canister that will be filled with samples cored from the surface of MARS. These spherical canisters will be 14.8 cm in diameter and must be powered only by solar cells on the surface and must communicate using RF transmission with the recovery vehicle that will be coming in 2006 or 2009 to retrieve the canister. This paper considers the aspect and conclusion that went into the design of the power system that achieves the maximum power with the minimum risk. The power output for the spherical orbiting canister was modeled and plotted in various views of the orbit by the SOAP program developed by JPL. The requirements and geometry for a solar array on a sphere are unique and place special constraints on the design. These requirements include 1) accommodating a lid for sample loading into the canister, surface area was restricted from use on the Northern pole of the spherical canister. 2) minimal cell surface coverage (maximum cell efficiency), less than 40%, for recovery vehicle to locate the canister by optical techniques. 3) a RF transmission during 50% of MARS orbit time on any spin axis, which requires optimum circuit placement of the solar cell onto the spherical canister. The best configuration would have been a 4.5 volt round cell, but in the real world we compromised with six triangular silicon cells connected in series to form a hexagon. These hexagon circuits would be mounted onto a flat facet cut into the spherical canister. The surface flats are required in order to maximize power, the surface of the cells connected in series must be at the same angle relative to the sun. The flat facets intersect each other to allow twelve circuits evenly spaced just North and twelve circuits South of the equator of the spherical canister. Connecting these circuits in parallel allows sufficient power to operate the transmitter at minimum solar exposure, Northern pole of the canister facing the sun. Additional power, as much as 20%, is also generated by the circuits facing MARS due to albedo of MARS.
Author
Mars Sample Return Missions; Electric Generators; Power Supply Circuits; Systems Engineering; Solar Arrays; Solar Cells

280

20000073843 NASA Langley Research Center, Hampton, VA USA
Preliminary Thermal Analysis of a Mars Sample Return Earth Entry Vehicle

Amundsen, Ruth M., NASA Langley Research Center, USA; Dec, John A., NASA Langley Research Center, USA; Mitcheltree, Robert A., NASA Langley Research Center, USA; Lindell, Michael C., NASA Langley Research Center, USA; Dillman, Robert A., NASA Langley Research Center, USA; 2000; 14p; In English; 34th; Thermophysics, 19-22 Jun. 2000, Denver, CO, USA; Original contains color illustrations

Thermal analysis of a vehicle designed to return samples from another planet, such as the Earth Entry vehicle for the Mars Sample Return mission, presents several unique challenges. The scientific purpose of a sample return mission is to return samples to Earth for detailed investigation. The Earth Entry Vehicle (EEV) must contain the samples after they have been collected and protect them from the high hearing rates of entry into the Earth's atmosphere. This requirement necessitates inclusion of detailed thermal analysis early in the design of the vehicle. This paper will describe the challenges and solutions for a preliminary thermal analysis of an Earth Entry Vehicle. The primary challenges included accurate updates of model .geometry, applying heat fluxes that change with position and time during exo-atmospheric cruise and entry, and incorporating orthotropic material properties. Many different scenarios were evaluated for the exo-atmospheric cruise to attain the desired thermal condition. The severity of the heat pulse during entry and the material response led to some unique modeling solutions. Overall, advanced modeling techniques and mathematical solutions were successfully used in predicting the thermal behavior of this complex system.
Author
Thermal Analysis; Samples; Mars Sample Return Missions; Heat Flux; Atmospheric Entry

20000074060 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
MOLA: The New Approach for Mars Global Cartography

Duxbury, Thomas C., Jet Propulsion Lab., California Inst. of Tech., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The MGS Orbiter is carrying the high-precision Mars Orbiter Laser Altimeter (MOLA) which, when combined with telemetered latitude data, provides a tie between inertial space and Mars-fixed coordinates to an accuracy of 100 m in latitude/longitude and 10 m in radius (1 sigma), orders of magnitude more accurate than previous global geodetic/ cartographic control data. Over the 2 year MGS mission lifetime, it is expected that over 30,000 MOLA Global Cartographic Control Points will be produced to form the basis for new and re-derived map and geodetic products, key to the analysis of existing and evolving MGS data as well as future Mars exploration.
Author
Laser Altimeters; Mapping; Mars Exploration; Telemetry; Celestial Geodesy

20000074082 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Cassini/Huygens Flyby of Jupiter

Matson, Dennis L., Jet Propulsion Lab., California Inst. of Tech., USA; Lebreton, Jean–Pierre, European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

At the and of the year 2000 the Cassini/Huygens spacecraft will fly by the planet Jupiter at a range of 137 jovian radii. A preliminary assessment has indicated that the instruments aboard Cassini/Huygens can make measurements that will make unique contributions to audio of the jovian system. In this presentation we will discuss the status of the plans for observations of the jovian system by Cassini/Huygens. We shall also consider the possibilities for observations carried out in cooperation with the Galileo spacecraft presently in orbit about Jupiter, with other spacecraft, and with various observatories on the ground.
Author
Cassini Mission; Jupiter (Planet); Space Probes

Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.

20000068433 Stanford Univ., Dept. of Physics, Stanford, CA USA

Observation and Modeling of the Solar Transition Region, 1, Multi-Spectral Solar Telescope Array Observations

Oluseyi, Hakeem M., Stanford Univ., USA; Walker, A. B. C., II, Stanford Univ., USA; Porter, Jason, NASA Marshall Space Flight Center, USA; Hoover, Richard B., NASA Marshall Space Flight Center, USA; Barbee, Troy W., Jr., Lawrence Livermore National Lab., USA; Astrophysical Journal; Oct. 20, 1999; Volume 524, pp. 1105-1121; In English; Original contains color illustrations
Contract(s)/Grant(s): W-7405-eng-48; NsG-5131; Copyright; Avail: Issuing Activity

We report on observations of the solar atmosphere in several extreme-ultraviolet and far-ultraviolet bandpasses obtained by the Multi-Spectral Solar Telescope Array, a rocket-borne spectroheliograph, on flights in 1987, 1991, and 1994, spanning the last solar maximum. Quiet-Sun emission observed in the 171-175 Angstrom bandpass, which includes lines of O v, O VI, Fe IX, and Fe X, has been analyzed to test models of the temperatures and geometries of the structures responsible for this emission. Analyses of intensity variations above the solar limb reveal scale heights consistent with a quiet-Sun plasma temperature of 500,000 less than or equal to T (sub e) less than or equal to 800,000 K. The structures responsible for the quiet-Sun EUV emission are modeled as small quasi-static loops. We submit our models to several tests. We compare the emission our models would produce in the bandpass of our telescope to the emission we have observed. We find that the emission predicted by loop models with maximum temperatures between 700,000 and 900,000 K are consistent with our observations. We also compare the absolute flux predicted by our models in a typical upper transition region line to the flux measured by previous observers. Finally, we present a preliminary comparison of the predictions of our models with diagnostic spectral line ratios from previous observers. Intensity modulations in the quiet Sun are observed to occur on a scale comparable to the supergranular scale. We discuss the implications that a distribution of loops of the type we model here would have for heating the local network at the loops' footpoints.
Author

Solar Atmosphere; Sun; Chromosphere; Mathematical Models; Space Observations (From Earth); Telescopes; Spectroheliographs; Solar Arrays

20000070379 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Constraining the Global, Cloud-Free Reflected Solar Radiation Flux (RSRF) with Earth Observing System (EOS) Instruments

Kahn, Ralph, Jet Propulsion Lab., California Inst. of Tech., USA; Climate Variability Program; April 1999, pp. 25; In English; See also 20000070362; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Variations in the top-of-atmosphere reflected solar radiation flux, and in the factors that determine its value, are among the most important diagnostic indicators of changes in Earth's energy balance. Data from the MISR (Multi-angle Imaging SpectroRadiometer), MODIS (Moderate-resolution Imaging Spectroradiometer), SAGE-3 (Stratospheric Aerosol and Gas Experiment), and CERES (Clouds and Earth's Radiant Energy System), all of which are spacecraft instruments scheduled for launch in 1999, will each constrain pieces of the RSRF budget. Prior to launch, we are performing studies to determine the sensitivity of these instruments to key factors that influence the cloud-free RSRF: aerosol optical depth, aerosol scattering properties, and surface visible bidirectional reflectance distribution function (BRDF). We are also assessing the ability of the aggregate of instruments to constrain the overall RSRF budget under natural conditions over the globe. Consider the MISR retrieval of aerosols: according to simulations over cloud-free, calm ocean, for pure particles with natural ranges of optical depth, particle size, and indices of refraction, MISR can retrieve column aerosol optical depth for all but the darkest particles, to an uncertainty of at most 0.05 or 20%, whichever is larger, even if the particle properties are poorly known. For one common particle type, soot, constraints on the optical depth over dark ocean are very poor. The simulated measurements also allow us to distinguish spherical from non-spherical particles, to separate two to four compositional groups based on indices of refraction, and to identify three to four distinct size groups between 0. 1 and 2.0 microns characteristic radius at most latitudes. Based on these results, we expect to distinguish air masses containing different aerosol types, routinely and globally, with multiangle remote sensing data. Such results far exceed current satellite aerosol retrieval capabilities, which provide only total optical depth for assumed particle properties; the new information will complement in situ data, which give details about aerosol size and composition locally. In addition, our team is using climatologies that reflect the constraints each instrument is expected to provide, along with ERBE (Earth Radiation Budget Experiment) data and a radiative transfer code, to study overall sensitivity to RSRF, helping us prepare for similar studies with new data from the EOS-era instruments.
Author

Aerosols; Optical Thickness; Reflected Waves; Spectral Reflectance; Solar Radiation

20000070868 NASA Marshall Space Flight Center, Huntsville, AL USA

A Prospective Method for Predicting Coronal Mass Ejections from Vector Magnetograms

Falconer, D. A., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Two quantitative measures of the global nonpotentiality of predominantly bipolar active regions are explored for their usefulness as indicators of whether an active region is likely to produce coronal mass ejections (CMEs). The two measures, length of strong-field strong-shear main neutral line (L_{ss})) and global net current (I_N)), are obtained directly from vector magnetograms of the regions. From measurements of L_{ss} and I_N in four active regions for which the global nonpotentiality and CME productivity are assessed independently of L_{ss} and I_N, it appears that L_{ss} and I_N are each a useful indicator of an active region's likely CME productivity. The results also suggest that L_{ss} and I_N may be more reliable predictors of the CME productivity of active regions than is the presence or absence of sigmoidal structure in coronal X-ray images of the regions, and that there might be threshold values of L_{ss} and I_N above which CME production is likely and below which CME production is unlikely. While these results need to be certified by an expansion of this pilot study to more active regions, they show the promise of Lss and I_N as quantitative measures of global nonpotentiality for CME prediction.
Author

Coronas; Stellar Mass Ejection; Procedures; Bipolarity

20000072880 NASA Marshall Space Flight Center, Huntsville, AL USA

Fine Structure in the Corona and Solar Wind at High Heliographic Latitudes at Solar Maximum

Suess. S. T., NASA Marshall Space Flight Center, USA; Poletto, G., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 34th; 34th ESLAB Symposium, 3-5 Oct. 2000, Noordwijk, Netherlands; No Copyright; Avail: Issuing Activity; Abstract Only

Microstreams and pressure balance structures in fast solar wind were more easily detected at Ulysses at 2.2 AU over the poles than at Helios at 0.3 AU. This is because solar rotation brings sources of fast solar wind beneath sources of slow solar wind at a rate that depends on latitude, for the same size features. Dynamic interaction between the fast and slow wind tends to mix the flows and make features more difficult to detect with increasing distance from the Sun. A given sized feature takes proportionally longer to pass a longitude when it is at 80 degrees latitude than when it is at the equator. At solar maximum, Ulysses will mainly be sampling solar wind coming from above streamers and from near streamers. The data will provide information on fine structure at the tops of streamers - the stalks - and on the source of slow solar wind, The visibility of the boundaries between fast and slow wind and of the stalk will increase with increasing latitude. We will present quantitative calculations of the visibility of various sized features, with various differences in flow speed, at the location of Ulysses when it is over the south (in 2000) and north (in 2001) polar regions of the Sun.
Author

Solar Activity Effects; Solar Wind; Solar Corona; Fine Structure; Polar Regions; Heliosphere

20000073289 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Outer Planets/Solar Probe Project: Solar Probe

Tsurutani, B. T., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Solar Probe, the first mission to the Sun and the third of three missions in NASA's Outer Solar System/Solar Probe Program, is a voyage of exploration, discovery, and comprehension. This near-Sun flyby will provide in situ measurements in the solar corona and high-resolution pictures and magnetograms of the photosphere and polar atmosphere. These measurements are also needed as "ground truth" for interpreting the many measurements of the Sun and solar activity that have been made from a distance of 1 AU. Solar Probe is scheduled for launch in February 2007. It will arrive at the Sun along a polar trajectory perpendicular to the Sun-Earth line with a perihelion of 4 solar radii (R_s)) from the Sun's center. Two perihelion passages will occur, the first in 2010 (near solar sunspot maximum) and the second in 2015 (near solar minimum) ensuring measurement of both coronal hole and streamer-related solar wind properties. to reach the Sun, probe must first fly to Jupiter and use a gravity assist to lose its angular momentum about the Sun. The imaging and in situ miniaturized instruments will provide the first 3-dimensional view of the corona, high spatial- and temporal-resolutions of the magnetic fields, and helioseismic measurements of the polar regions, as well as sporadic high-spatial-resolution local sampling of plasmas and fields at all latitudes.
Author

Flyby Missions; Solar Probes; Sun; Spacecraft Trajectories

20000073293 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
Microstructures in the Polar Solar Wind: Ulysses

Tsuruyani, Bruce T., Jet Propulsion Lab., California Inst. of Tech., USA; Arballo, J. K., Jet Propulsion Lab., California Inst. of Tech., USA; Galvan, C., Jet Propulsion Lab., California Inst. of Tech., USA; Goldstein, B. E., Jet Propulsion Lab., California Inst. of Tech., USA; Lakhina, G. S., Jet Propulsion Lab., California Inst. of Tech., USA; Sakurai, R., Jet Propulsion Lab., California Inst. of Tech., USA; Smith, E. J., Jet Propulsion Lab., California Inst. of Tech., USA; Neugebauer, M., Jet Propulsion Lab., California Inst. of Tech., USA; 1999; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We find that small (10-200 rP) magnetic decreases comprise a dominant part of the polar solar wind microstructure at Ulysses distances (2.2 AU). These magnetic field dips are almost always bounded by tangential discontinuities, a feature which is not well understood at this time. Hundreds of these events have been examined in detail and a variety of types have been found. These will be described. It is speculated that these structures have been generated by perpendicular heating of ions closer to the Sun and have then been convected to distances of Ulysses. Such structures may be very important for the rapid cross- field diffusion of ions in the polar regions of the heliosphere.
Author
Heliosphere; Solar Wind; Sun; Solar Physics; Solar Magnetic Field

20000074094 NASA Marshall Space Flight Center, Huntsville, AL USA
SUMI: The Solar Ultraviolet Magnetograph Investigation

Davis, John M., NASA Marshall Space Flight Center, USA; Porter, Jason G., NASA Marshall Space Flight Center, USA; Gary, G. A., NASA Marshall Space Flight Center, USA; West, Edward A., NASA Marshall Space Flight Center, USA; Rabin, Douglas M., NASA Marshall Space Flight Center, USA; Thomas, R. J., NASA Marshall Space Flight Center, USA; Davila, J. M., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; 31st; 31st Meeting of the Solar Physics Division, 19-22 Jun. 2000, Stateline, NV, USA; Sponsored by American Astronomical Society, USA; No Copyright; Avail: Issuing Activity; Abstract Only

A major focus of solar physics is the measurement of the temporal and spatial variability of solar magnetic fields from the photosphere into the lower corona, together with the study of how their behavior produces the dynamic phenomena in this region such as flares and Coronal Mass Injection (CMEs). Considerable success has been achieved in the characterization of the full vector field in the photosphere, where P, the ratio of the gas pressure to the magnetic pressure, is greater than or equal to 1. At higher levels in the atmosphere where beta is less than 1, the magnetic field (through the Lorentz force) controls the structure and dynamics of the solar atmosphere, and rapid changes in structure with release of energy become possible. However, observations of the field at these higher levels have proven to be difficult, placing a serious limitation on our understanding of the physical processes occurring there. This poster will discuss the Solar Ultraviolet Magnetograph Investigation (SUMI), a hardware development study for an instrument capable of measuring the polarization in ultraviolet lines of C IV and Mg II formed in the transition region and upper chromosphere. We are currently developing optical technologies necessary to build an instrument that will achieve a major advance in performance over that of earlier attempts (e.g., SMM/UVSP). Initially configured as a sounding rocket payload, such a UV magnetograph would allow us to make exploratory measurements extending the observation of solar magnetic fields into new and dynamic regimes. This work is supported by NASA through the SEC Program in Solar Physics and the program for Technology Development for Explorer Missions and Sofia.
Author
Magnetometers; Solar Physics; Ultraviolet Spectra; Solar Atmosphere; Solar Instruments

20000074115 NASA Marshall Space Flight Center, Huntsville, AL USA
Solar Wind

Suess, S. T., NASA Marshall Space Flight Center, USA; Tsurutani, B. T., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The sun is losing mass in form of the solar wind, which has affected its evolution from its birth and will continue to do so until its death. This is not unusual in that nearly all stars are losing mass through stellar winds throughout a major portion of their lives. As far as the Earth is concerned, the solar wind blows against the Earth's magnetosphere, causes aurora and geomagnetic storms, and can affect the Earth's climate.
Author
Solar Wind; Stellar Winds; Auroras; Sun

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see 52 Aerospace Medicine. For theory see 73 Nuclear Physics.

20000068432 NASA Marshall Space Flight Center, Huntsville, AL USA

Statistical Properties of SGR 1806-20 Bursts

Gogus, Ersin, NASA Marshall Space Flight Center, USA; Woods, Peter M., NASA Marshall Space Flight Center, USA; Kouveliotou, Chryssa, NASA Marshall Space Flight Center, USA; VanParadijs, Jan, Alabama Univ., USA; Briggs, Michael S., NASA Marshall Space Flight Center, USA; Duncan, Robert C., Texas Univ., USA; Thompson, Christopher, North Carolina Univ., USA; Astrophysical Journal; Apr. 01, 2000; Volume 532, pp. L121-L124; In English

Contract(s)/Grant(s): NCC8-65; NAG5-3674; NAG5-7787; NAG5-7849; NAG5-8381; ARP-028; Copyright; Avail: Issuing Activity

We present statistics of SGR 1806-20 bursts, combining 290 events detected with the Rossi X-Ray Timing Explorer/Proportional Counter Array, 111 events detected with the Burst and Transient Source Experiment, and 134 events detected with the International Cometary, Explorer. We find that the fluence distribution of bursts observed with each instrument are well described by power laws with indices 1.43, 1.76, and 1.67, respectively. The distribution of time intervals between successive bursts from SGR 1806-20 is described by a lognormal function with a peak at 103 s. There is no correlation between the burst intensity and either the waiting times until the next burst or the time elapsed since the previous burst. In all these statistical properties, SGR 1806-20 bursts resemble a self-organized critical system, similar to earthquakes and solar flares. Our results thus support the hypothesis that the energy source for soft gamma repeater bursts is crustquakes due to the evolving, strong magnetic field of the neutron star, rather than any accretion or nuclear power.
Author

Gamma Ray Bursts; Statistical Distributions; Statistical Analysis; X Ray Astronomy

20000070718 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Origin of Cosmic Rays: What can GLAST Say?

Ormes, Jonathan F., NASA Goddard Space Flight Center, USA; Digel, Seith, NASA Goddard Space Flight Center, USA; Moskalenko, Igor V., National Academy of Sciences - National Research Council, USA; Moiseev, Alexander, NASA Goddard Space Flight Center, USA; Williamson, Roger, Stanford Univ., USA; [2000]; 4p; In English; ACE2000 Conference, 4-8 Jan. 2000, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Gamma rays in the band from 30 MeV to 300 GeV, used in combination with direct measurements and with data from radio and X-ray bands, provide a powerful tool for studying the origin of Galactic cosmic rays. Gamma-ray Large Area Space Telescope (GLAST) with its fine 10-20 arcmin angular resolution will be able to map the sites of acceleration of cosmic rays and their interactions with interstellar matter, It will provide information that is necessary to study the acceleration of energetic particles in supernova shocks, their transport in the interstellar medium and penetration into molecular clouds.
Author

Galactic Cosmic Rays; Gamma Ray Telescopes; Molecular Clouds

20000073214 NASA Marshall Space Flight Center, Huntsville, AL USA

Statistical Properties of SGR 1900+14 Bursts

Gogus, Ersin, NASA Marshall Space Flight Center, USA; Woods, Peter M., NASA Marshall Space Flight Center, USA; Kouveliotou, Chryssa, NASA Marshall Space Flight Center, USA; VanParadijs, Jan, Alabama Univ., USA; Astrophysical Journal; Dec. 01, 1999; Volume 526, pp. L93-L96; In English

Contract(s)/Grant(s): NCC8-65; NAG5-3674; NAG5-7060; NAG5-8381; ARP-028; Copyright; Avail: Issuing Activity

We study the statistics of soft gamma repeater (SGR) bursts using a database of 187 events detected with BATSE and 837 events detected with the Rossi X-Ray Timing Explorer Proportional Counter Array: all events are from SGR 1900+14 during its 1998-1999 active phase. We find that the fluence or energy distribution of bursts is consistent with a power law of index 1.66, over 4 orders of magnitude. This scale-free distribution resembles the Gutenberg-Richter law for earthquakes and gives evidence for self-organized criticality in SGRS. The distribution of time intervals between successive bursts from SGR 1900+14 is consistent with a lognormal distribution. There is no correlation between burst intensity and the waiting times till the next burst, but there is some evidence for a correlation between burst intensity and the time elapsed since the previous burst. We also find a correlation between the duration and the energy of the bursts, but with significant scatter. In all these statistical properties, SGR bursts resemble earth-

quakes and solar flares more closely than they resemble any known accretion-powered or nuclear-powered phenomena. Thus, our analysis lends support to the hypothesis that the energy source for SGR bursts is internal to the neutron star and plausibly magnetic.
Author

Gamma Ray Bursts; Gamma Ray Observatory; Statistical Distributions; Astrophysics; Soft Gamma Repeaters; Data Bases

20000073842 NASA Langley Research Center, Hampton, VA USA

An Improved Elastic and Nonelastic Neutron Transport Algorithm for Space Radiation

Clowdsley, Martha S., NASA Langley Research Center, USA; Wilson, John W., NASA Langley Research Center, USA; Heinbockel, John H., Old Dominion Univ., USA; Tripathi, R. K., NASA Langley Research Center, USA; Singleterry, Robert C., Jr., NASA Langley Research Center, USA; Shinn, Judy L., NASA Langley Research Center, USA; July 2000; 42p; In English
Contract(s)/Grant(s): RTOP 101-21-23
Report No.(s): NASA/TP-2000-210299; L-17971; NAS 1.60:210299; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A neutron transport algorithm including both elastic and nonelastic particle interaction processes for use in space radiation protection for arbitrary shield material is developed. The algorithm is based upon a multiple energy grouping and analysis of the straight-ahead Boltzmann equation by using a mean value theorem for integrals. The algorithm is then coupled to the Langley HZETRN code through a bidirectional neutron evaporation source term. Evaluation of the neutron fluence generated by the solar particle event of February 23, 1956, for an aluminum water shield-target configuration is then compared with MCNPX and LAHET Monte Carlo calculations for the same shield-target configuration. With the Monte Carlo calculation as a benchmark, the algorithm developed in this paper showed a great improvement in results over the unmodified HZETRN solution. In addition, a high-energy bidirectional neutron source based on a formula by Ranft showed even further improvement of the fluence results over previous results near the front of the water target where diffusion out the front surface is important. Effects of improved interaction cross sections are modest compared with the addition of the high-energy bidirectional source terms.
Author

Neutron Sources; Algorithms; Particle Interactions; Shielding; Boltzmann Transport Equation; Radiation Protection; Extraterrestrial Radiation; Elastic Properties

20000074053 Oxford Univ., Physics Dept., Oxford, UK

On the Redshift Cut-Off for Flat-Spectrum Radio Sources

Jarvis, Matt J., Oxford Univ., UK; Rawlings, Steve, Oxford Univ., UK; 2000; 22p; In English; Copyright; Avail: Issuing Activity

We use data from the Parkes Half-Jansky Flat-Spectrum (PHJFS) sample to constrain the cosmic evolution in the co-moving space density rho of radio sources in the top decade of the flat-spectrum radio luminosity function (RLF). A consistent, picture for the high-redshift evolution is achieved using both simple parametric models, which are the first to allow for distributions in both radio luminosity and spectral index, and variants of the V/V(sub max) test, some of which incorporate the effects of radio spectral curvature. For the most luminous flat-spectrum objects, the PHJFS sample is extremely similar to that used by Shaver et al. to argue for an abrupt, 'redshift cut-off': a decrease by a factor about 30 in rho between a, peak redshift z approximates 2.5 and z about 5. Our analysis finds that the observable co-moving volume is too small to make definitive statements about any redshift cut-off for the most, luminous flat-spectrum sources, although both constant-rho (no cut-off) models and models with cut-offs as abrupt as those envisaged by Shaver et al. are outside the 90% confidence region. The inference that the decline in rho is most likely to be gradual, by a factor about 4 between z approximates 2.5 and z about 5, is in accordance with previous work on the RLF by Dunlop & Peacock, but different to the abrupt decline favoured by studies of optically-selected quasars. Dust, obscuration provides one explanation for this difference. We show that a significant fraction of the most radio-luminous flat-spectrum objects are Giga-Hertz Peaked Spectrum (GPS) rather than Doppler-Boosted (DB) sources, complicating any interpretation of the redshift cut-off. Studies based on objects extending into the next lower decade of the flat-spectrum RLF are likely to be more fruitful but will require a separation of the GPS and DB populations, careful radio selection and analysis of K-corrections, and larger sky-area redshift surveys than those currently available.
Author

Quasars; Red Shift; Spectra; Cosmology; Galactic Evolution; Radio Astronomy

20000074077 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Initial Results from a Search for Lunar Radio Emission from Interactions of is greater than = 10(exp 19) eV Neutrinos and Cosmic Rays

Gorham, P. W., Jet Propulsion Lab., California Inst. of Tech., USA; Liewer, K. M., Jet Propulsion Lab., California Inst. of Tech., USA; Naudet, C. J., Jet Propulsion Lab., California Inst. of Tech., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Using the NASA Goldstone 70m antenna DSS 14 both singly and in coincidence with the 34 m antenna DSS 13 (21.7 km to the southeast), we have acquired approximately 12 hrs of livetime in a search for predicted pulsed radio emission from extremely-high energy cascades induced by neutrinos or cosmic rays in the lunar regolith. In about 4 hrs of single antenna observations, we reduced our sensitivity to impulsive terrestrial interference to a negligible level by use of a veto afforded by the unique capability of DSS 14. In the 8 hrs of dual-antenna observations, terrestrial interference is eliminated as a background. In both observing modes the thermal noise floor limits the sensitivity. We detected no events above statistical background. We report here initial limits based on these data which begin to constrain several predictions of the flux of EHE neutrinos.
Author

Radio Emission; Lunar Radiation; Neutrinos; Cosmic Rays

20000074102 NASA Marshall Space Flight Center, Huntsville, AL USA
Joint Discussion/Mini-Workshop: Gamma-Ray Bursts and their Hosts
Fishman, Gerald J., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 29 May - 3 Jun. 2000, Moscow, Russia; No Copyright; Avail: Issuing Activity; Abstract Only

The observed gamma-ray temporal, spectral, intensity and spatial distribution characteristics of GRBs, primarily from data obtained from the Compton Observatory, will be described. The talk will concentrate on recent studies of burst properties, correlations of GRB parameters and other statistical studies that have only recently come to light with the unprecedented sample of over two thousand GRBs, along with some mention of studies in progress by members of the BATSE team.
Author

Gamma Ray Bursts; Gamma Rays; Gamma Ray Astronomy; Temporal Distribution; Spatial Distribution; Spectral Energy Distribution

20000074105 NASA Marshall Space Flight Center, Huntsville, AL USA
GRB 990712: First Detection of Polarization Variability in a Gamma-ray Burst Afterglow
Rol, E., Amsterdam Univ., Netherlands; Wijers, R. A. M. J., State Univ. of New York, USA; Vreeswijk, P. M., Amsterdam Univ., Netherlands; Galama, T. J., California Inst. of Tech., USA; vanParadijs, J., Amsterdam Univ., Netherlands; Kouveliotou, C., NASA Marshall Space Flight Center, USA; Pian, E., Consiglio Nazionale delle Ricerche, Italy; Palazzi, E., Consiglio Nazionale delle Ricerche, Italy; Frontera, F.; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

We report the detection of significant polarization in the afterglow of GRB 990712 on three instances 0.44-1.45 days after the gamma-ray burst. This polarization is intrinsic to the afterglow. The degree of polarization is not constant, and smallest at the second measurement. The polarization angle does not vary significantly during these observations. We find that none of the existing models predict such polarization variations constant polarization angle, and discuss ways in which these models might be modified to accommodate the observed behavior of this afterglow.
Author

Afterglows; Gamma Ray Bursts; Polarization (Waves); Synchrotrons

20000074110 NASA Marshall Space Flight Center, Huntsville, AL USA
The BATSE Gamma-Ray Burst E-Peak Distribution
Brainerd, Jerome J., NASA Marshall Space Flight Center, USA; Pendleton, Geoffrey N., NASA Marshall Space Flight Center, USA; Mallozzi, Robert S., NASA Marshall Space Flight Center, USA; Briggs, Michael S., NASA Marshall Space Flight Center, USA; Preece, Robert D., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Gamma-ray burst observed by BATSE are found to have approximately the same characteristic energy, denoted as E_p. We examine whether instrumental effects can give rise to this observation. We simulate the derivation of E-p and determine that the values in the BATSE sample are accurate and complete above a minimum fluence. We simulate the triggering of BATSE on gamma-ray bursts, deriving the efficiency of detecting bursts as a function of characteristic energy. From this simulation, we model the observed E_p distribution function expected when the intrinsic distribution function is a power-law. We find that this distribution produces poor fits to the observations. We find that a log-normal intrinsic distribution with a power-law tail gives a good fit to the data. From these fits, we conclude that instrumental effects cannot produce the observed E_p distribution, and that the observed distribution is a consequence of a narrow intrinsic distribution of E_p in gamma-ray bursts.
Author

Gamma Ray Bursts; Gamma Rays; Gamma Ray Observatory

Subject Term Index

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